TREATMENT AND PROPHYLAXIS OF MALARIA

With Special Reference to Nyasaland.

Thesis for the Degree of M.D.

by

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INTRODUCTION.

There are few tropical diseases which have received more attention than Malaria, but so diverse are the conditions under which it occurs, so different are the means by which it may be suppressed or eradicated, that it is of the utmost importance that special attention should still be paid to this disease in each and every portion of the globe it infests, with a view to prophylaxis and treatment.

Having been medical officer to the Blantyre Mission in Nyasaland for twelve years, I have been brought into close contact with malaria as it exists there, as my work includes the supervision of a native hospital of 62 beds and out-patient department, and also the treatment of Europeans.

Nyasaland has a short but interesting history. Livingstone first explored it along with Sir John Kirk in 1859 and in 1861 he discovered Lake Nyasa from which the country takes its name. In the light of present day facts it is interesting to note what Livingstone said about 'fever':- "A great deal of fever comes on in March and April. In March if considerable intervals take place between the rainy days, and in April always, for then large surfaces of mud and decaying vegetation are exposed to the hot sun."

The Universities Mission in the same year made an abortive attempt to establish themselves in the country, but it was not till 1875, when Mission parties were sent/

sent out by the Church of Scotland, and the Free Church of Scotland, that European settlements in the country were actually formed. After that history was rapidly made, the British Government establishing the British Central African Protectorate in 1891, which title was changed to Nyasaland when the country became a Crown Colony in 1905.

Geography and Physical Geography.

Situated as it is between 10 and 16 degrees South of the Equator, Nyasaland is mainly tropical in character, though those parts of it situated over 4000 ft. above sea-level have a more sub-tropical appearance - palms, tree-ferns, baobab trees, etc. being absent from the landscape.

The accompanying Maps (1,2 & 2a) show the position of Nyasaland, and its relative altitudes.

The rainfall averages about 50 inches per annum, though the amount varies much in different localities as seen in Map 3.

In years of drought the average may drop to 35 inches.

The result of this rainfall and temperature is that everywhere we meet with luxurious vegetation and specially thick undergrowth, though for the most part the undergrowth is annually burnt up by the bush fires which take place.

Although/

Although it is rare for a month to pass without any rain falling, the year is clearly divided into two seasons of rain and drought. The rainy season begins towards the end of November, and goes on till the end of March, the rain during this time being torrential in nature. After this the cool season sets in, and what rain there is usually falls in light showers.

The temperature also varies considerably. In the valley of the Shiré, on the shore of Lake Nyasa, and in the Luangwa Valley, the heat is as much as 118°F. in the shade during the day just before the November rains, and during December, January, and February, when the rains have come, the temperature is still above 100° F. and the moisture in the air makes it very trying to live in.

However at altitudes above 2,500 ft. - and these altitudes represent the bulk of the country - the temperature is much more tolerable for the cold season temperature ranges between 40° and 75° F., and the hot season between 60° and 95° F.

The Shiré Highlands themselves where Blantyre is situated, are a mass of beautiful hills lying between the Ruo and Shiré rivers and Lake Chilwa, ranging in height from 3,000 to 7,000 feet.

Geology.

The commonest formation is a mixture of metamorphic rocks, clay-slates, gneiss and schists, above which/

which is a stratum of alluvial deposits where the valleys are broad.

The mountain ranges are principally granite, the upper layers of which are often 'rotten' forming a red ferruginous clay.

Native Population.

The total number of natives in Nyasaland is over 900,000, and of these over 100,000 live in the Shiré Highlands. Map 4 shows the relative density of the population in the various districts.

Although the former tendency was for the natives to live in large stockaded villages containing 300 or 400, or up to 1000 huts, present conditions of peace have tended to the dispersion of these villages, little hamlets of 10 to 12 huts or solitary houses taking their place. At the same time the power of most of the big chiefs is broken, and though head-men are recognised in all the districts, their influence is a small and diminishing one, and they cannot be used as a lever to institute reforms in Hygiene and Public Health.

The evil effects, owing to lack of adequate control and supervision, have become so apparent that the Government has now stepped in and forbidden the building of small isolated huts, and has ordered and carried out the gathering together of all huts in groups of 30 to 60.

The universal belief that all disease is caused by witchcraft, that no deaths occur from natural causes, is in itself a hindrance to any measure brought forward to lessen disease. Even school boys laugh at the idea that pain in their stomach can possibly be caused by anything they have put into it.

Village Conditions.

The village is usually placed near some convenient pool or stream so that the women may not have to carry the water a great distance for household use. During the dry season in many places the people are dependent for water on water-holes dug in the sandy beds of streams.

The houses are built in a variety of styles; two or three roomed houses built of poles with mud walls and grass roofs, and possessing wooden doors and small windows, are much in evidence wherever you have the touch of civilisation, while in the ordinary village the old fashioned low-roofed, square or round, dark hut with one entrance acting as door and window still persists.

The natives are on the whole cleanly in habits, daily ablution being the rule and not the exception.

The village school is now a recognised institution almost all over Nyasaland as may be seen from the fact that there are almost 100,000 scholars on the rolls of the various missions at work, and it is in these schools and their teachers that the hope lies of all successful/

successful prophylactic measures in the future.

Labour Conditions.

The soil is naturally fertile and agriculture is the main industry of the country. The supply of sufficient food for a whole family only entails a very moderate amount of labour during the rainy season when the ground has to be prepared and the weeds kept down.

Now however that the native desires luxuries in the way of dress and household effects he usually works for a European in the neighbourhood, if there be one, for one or more months, which work also gives him a remission of his hut-tax from 8/- to 4/-. In event of there being no European near the native, then he often travels to where work may be found, and is indentured there, under Government Regulations as regards housing and feeding, etc., for six months or so.

All planters and trading companies employ many thousands of natives annually in this way, and by having them under their direct care a large field for prophylactic measures as far as they are concerned is opened up.

European Conditions.

In Townships.

There are several townships in Nyasaland with a population of 50 to 150 Europeans, while near at hand there is usually an equally large Indian quarter.

No/

No native quarters exist inside the township, but sleeping accommodation is usually provided for house-boys just at the back of the European's house. In some cases these servants are married men and have their wives and children with them. The European houses are always substantially built of brick, with corrugated iron, tile, or wooden shingle roofing.

A very few houses are mosquito proof throughout. Some have one or two mosquito proof rooms, but in the majority of cases mosquito bed-nets only are used.

The water supply is usually satisfactory being got from shallow but carefully protected wells.

Guttering is commonly used to lead the rain water to storage tanks for household purposes.

In the Country.

The average planter builds a good house of brick, roofed with grass, tiles, or shingles, and the general arrangement is the same as in townships except that he nearly always has his labourers' huts within 400 yards of his house for easy supervision. A stream is inevitably near, where the natives may easily obtain water. The majority of natives seeking work are employed on these plantations during the rainy season. The source of the country's wealth lies mainly in these plantations of cotton, coffee, tobacco, tea, fibre, chillies, etc.

Medical Conditions.

Government/

Government Medical Service.

The Government Medical Service is primarily for Government officials, and only secondarily for the benefit of the European and native community. Small grants are made to Government Medical Officers for treating natives and two or three small native hospitals have been erected but no attempt is made to develop this work.

The Government Medical Officers are also responsible for the Public Health of the district, but their work is largely confined to vaccination, and Sleeping Sickness work. The personnel of the service consists of 10 Medical Officers and a Principal Medical Officer. Lake Nyasa itself has a square area equal to Scotland and England so the medical staff must be either very inadequate - or very overworked!

Mission Medical Service.

There are 13 medical missionaries at work, the majority of whom have school and church work to supervise, as well as their medical duties.

There are however native medical training Institutions at Blantyre and Livingstonia in charge of whole time medical officers where natives are trained in hospital work, laboratory methods, etc., so that they may be fitted for district work under medical supervision. The usual course is one of four years.

At these Institutions lectures are also given in Physiology,/

Physiology, First Aid, Common Diseases of the Country, Elementary Hygiene and Public Health, etc., to the teachers in training.

Type of Malaria Prevalent.

The malignant tertian parasite is the form most frequently found, simple tertian being the exception, and quartan very rarely seen.

The type of fever seen in Blantyre and other places similarly situated about 3000 feet above sea level is comparatively mild in character, and very amenable to treatment, but at lower levels hyperpyrexial forms are often met with, while blackwater fever - which is always associated in Nyasaland with intense malaria - causes a large death rate in the European Community.

Malaria in all its forms is the chief factor in retarding the prosperity of the country, as it causes so much ill health, loss of time, and total break down amongst Europeans; while also, the future of the country depending so much upon the plentiful supply of healthy labour, malaria / plays a large part in keeping down and diminishing the vigour of the native population.

HISTORICAL OUTLINE.

The exact portion of the world in which Malaria originated is still a matter of conjecture.

Jones[1] seems effectively to dispose of the idea that it was prevalent in Greece from earliest times, though it was certainly endemic throughout a large portion of the Greek world in 400 B.C., being referred to by Hippocrates and Aristophanes. Before that period however references to Malaria are scanty and doubtful. Homer (1,100 B.C.) only mentions what might be malaria once, and Hessird (735 B.C.), though he lived at Orchomenus (now intensely malarious) on the shore of Lake Kopais, and deals with rural subjects, makes no mention of it even indirectly.

Besides the inference from writings, the virility and strenuousness of the Greeks at the height of their power bespeak a people free from the enervating effects of malaria.

It is therefore highly probable that it was introduced into Greece from without, the original parasites doubtless being conveyed in the blood of slaves from a malarious portion of Africa.

This portion does not seem to have been Egypt, there being no references to Malaria amongst the medical papyri, or temple inscriptions.

It is more than likely that its true home was in some portion of Equatorial Africa where the temperature throughout all the ages has been the most equitable, and/

and where there would be the least interruption of those unknown processes which resulted in the establishment of the present life-cycle of the malarial parasite.

Wherever it originated, there are two facts that immediately concern us - it is now prevalent in most of our tropical possessions, and it is essentially a preventable disease.

The history of the discovery of the plasmodium malariae by Laveran in 1880, the suggestion by Manson in 1894 that a mosquito might prove to be an intermediate host, the proof that the anophelene group of Eulicidae were the carriers made by Ross in 1897, are too well known to be detailed here.

I shall now however refer to the practical results of these discoveries as shown by anti-malarial campaigns organised in various parts of the world. For the purpose of useful comparison with conditions in Nyasaland, I shall confine myself to campaigns in rural and semi-rural districts.

Greece.

We may learn much from the anti-malarial measures adopted in Greece.[2] Stimulated by the success of the anti-malarial operations in Italy a League was formed in 1905 to organise preventative measures.

The necessity for some such action is shown by the fact that out of a population of almost 3,000,000 people/

people 29% are affected every year.

The general features of the country are entirely favourable to the perpetuation of malaria, suitable breeding places for mosquitoes being found in the numerous marshes, and in the pools in the torrent-beds of the streams.

The League first of all propagated the latest scientific knowledge concerning malaria and its prevention amongst medical and leading public men. At the same time school-masters and school-children were instructed, and the children told their parents, so that in this way the new knowledge was spread amongst the various strata of society - with the help also of lantern lectures and leaflets. Next the provision of Quinine was regulated. The State established no monopoly, but fixed its price and ensured its purity. Tablets of Quin. Bisulph 0.20 grm. were put on the market. This was usually sold in packets of 10 glass tubes, each tube containing five tablets. The dose recommended was 1 grm. (5 tablets) per day for a week, than 2 tablets a day for 2 months. A prophylactic dose of 0.40 grm. every day from May to September was also recommended. For children Quinine Tannate 0.85 grm. (= 0.30 grm. anhydrous quinine) was also provided.

An Object Lesson.

It was felt however that the best way to prove the practicability of anti-malarial measures, to convince/

convince sceptics, and to arouse the indifferent, would be to carry such measures into effect in a typical malarious district, and for this purpose the historical district of Marathon was chosen.

The population was 1680 and practically all were infected with malaria, for in the schools 100% of the pupils had enlarged spleens, and during 1907 84% of the people suffered from malaria.

Anophelines were found present in the pools left in the torrent beds, and in the surrounding marshes. The streams were 'trained' to get rid of the majority of the pools, and the remainder were treated with petroleum.

Quinine was given by different systems for 3 years as shown in the following tables:-

Year	1907.	1908.	1909.
System	Koch's Curative & Preventive.	Italian Curative & Preventive.	Austrian Curative only.
Curative Dose.	1 grm - 1.5 grm for 1 wk. then 0.40 grm for 2 months.	The same.	The same.
Preventive Dose.	1 grm. daily for 2 successive days a week.	.40 grm. daily.	——
Remarks on Preventive Dose.	The discomfort (quinism) caused complaints and many stopped treatment	No complaints	——
Amount of quinine per head.	15.6 grms.	32.3 grms.	5.6 grms.
Cost per head.	3.7 fr.	6.15 fr.	1.69 fr.
Results.	Of 1.252 persons taking quinine, 47% suffered * from malaria, compared with 90% in the surrounding villages.	Of 1,306 persons 4.28% were attacked.	Of 1312 persons 176 or 13.41% were attacked.

* As noted above many gave up the prophylactic use of quinine, but of 67 people who took quinine prophylactically for 21 - 24 weeks none were attacked.

After this successful experiment similar measures were tried elsewhere with equally good results, the main feature in all being the general use of quinine given by one or other of the above systems.

Isthmus of Panama.

No more striking success has been seen anywhere than that of the anti-malarial measures adopted under the guidance of Colonel Gorgas in the Isthmus of Panama along the route of the new Canal.

The bringing of this scheme to a successful conclusion depended quite as much upon the endeavours of those in charge of the medical department to overcome malaria, yellow fever, and dysentery, as upon the overcoming of the mechanical difficulties.

The campaign was laid down on broad lines. It was not a question of which was the best anti-malarial method, it was a case of the correlation of all methods which may be summarised as follows:- (1) Drainage. (2) Bush and grass cutting. (3) Oiling. (4) Use of Larvicide. (5) Prophylactic Quinine. (6) Screening. (7) Killing mosquitoes in quarters.

Let us note what is meant by these headings.

1. Drainage.

All pools were drained within 200 yards of villages, and 100 yards of houses. Porous sub-soil pipes were used wherever possible. Concrete ditches were made where the volume of water was large, or the/

the fall small. Open ditches were avoided as far as possible as they required constant attention, and were therefore most costly in the end.

2. Bush and Grass Cutting.

Emphasis was laid upon the necessity of keeping the grass less then 1 foot high at the above distances from buildings, as anophelines - of certain species at least - will not usually cross a cleared area of 100 yards.

3 & 4. Oiling and Larvicide.

Used at the edges of swamps and streams - the larvicide being used where the oil will not spread.

5. Prophylactic Quinine.

Quinine was given gratis. One half of the negro population took it.

6. Screening.

Mosquito proof houses, and mosquito nets, became less necessary as other anti-malarial measures succeeded.

7. Killing mosquitoes in quarters.

This method entailed the systematic killing of mosquitoes - many of which would be infected - every morning in tents and small buildings.

Cost./

Cost.

Sanitation generally cost 3½ dollars per head per annum, of which sum 2 dollars was on anti-malarial work.

Results.

Death was reduced from 16.21 per 1000 per annum to 2.58, and at the same time yellow fever was eradicated.

These measures were however only one side of the question, and much research work was carried out at the same time that prophylactic measures might be intelligently applied.

Bionomics of the Anophelines.

It was noted that particular breeding places were selected by the different varieties, that some preferred well aerated water, some water containing algae, others brackish water, some sunlight, others shade. Again, amongst the list of anophelines, only a few were found to be the usual carriers of malaria.

Limit of Infectiousness of Man.

This was an important point to determine, for on it depended whether or not a patient not completely cured from malaria could transmit the disease to others. By careful infecting experiments it was determined that 1 gamete per 500 leucocytes (or 12 gametes per c.m.m.) is the minimum amount necessary to convey infection from man to mosquito.

The/

The curative action of quinine was also carefully noted, for it was found that by its systematic use the number of gametes could be reduced to below the above number.

The following cases illustrate this:-

Case 51, 499. Treatment = Quin. gr. X. t.i.d.

	Dec.		Jan.							Feb.
Date	30	31	2	5	6	8	13	15	23	1
Crescents per 100 leucocytes	67	42	76	46	40	15.5	9	5	.5	0

Case 48, 987. Treatment = no quinine given.

	Nov.				Dec.
Date	11	24	27	30	4
Crescents per 100 leucocytes.	16	27	12	8	20

Case 53, 937. Treatment = Quin. gr. X t.i.d. Fowler's Solution m. 5 t.i.d.

	Feb.									
Date	5	6	8	9	11	14	15	16	17	19
Crescents per 100 leucocytes	92	87	61	48	20	3.5	4	3	2	0.5

Africa.

Turning to Africa we find that some very important observations were made by Drs. Stephens, Christophers, and Damels, chiefly in Nyasaland (B.C. Africa), and on the West Coast (Accra, etc.)

They established the following points:-

1. That native children under 12 years act as 'reservoirs' for the malarial parasite, and that malaria is usually transmitted from the infected children to Europeans.

At Accra two types of native houses were examined:-

(a) Breeding places of Anopheles close at hand.

Thirteen houses containing 41 children were examined and 25 children were found infected (only one film was taken so the actual infection would probably be higher than this).

(b) Breeding places 200-800 yards away.

Ten houses with 15 children examined and 13 children were found to be infected.

The parasite in each case was the malignant tertian, and amongst the anophelines caught in the huts almost 10% were found to be infected.

It therefore is apparent that it is courting malaria to have dwellings in the neighbourhood of such huts; yet the usual arrangement all over tropical Africa is to have the native quarters close to the European's house, and for travellers to camp near a native village, or to sleep in one of the huts.

huts.

The distance that anophelines fly normally has been variously computed, but it is generally agreed that 400 yards represents the limit of normal flight - a few migratory species fly further than this - so that there should be usually no difficulty in arranging for the segregation of Europeans.

2. That malaria can be diagnosed in the absence of parasites (a condition of affairs which is common after the first 18 hours of the asexual cycle of malignant tertian parasites, and also after taking quinine) by the following indications:-

(a) A large Mononuclear increase extending throughout attack but most marked during the apyrexial period.

(b) Presence of Pigmented Leucocytes.

3. Lastly they demonstrated that blackwater fever is found where there is a high malarial index, (The malarial index of a locality is taken by finding the percentage of native children under 12 years infected with malaria) and that though parasites may not be seen in the peripheral circulation after haemoglobinuria sets in, yet, the other signs of malaria mentioned in the last paragraph are present.

ETIOLOGICAL/

ETIOLOGICAL CONSIDERATIONS.

Predisposing Causes.

General.

Soil.

Soil, the overturning of which used to be considered the main cause of malaria owing to the miasma which exuded, is now known only to be of importance in so far as it affects the formation of springs, marshes, swamps, lakes, and rivers, with the attendent facilities for mosquito production that these give rise to.

In the large valleys and plains of Nyasaland there is considerable alluvial deposit, but in the highlands round Blantyre and elsewhere the granite outcrops in many places giving rise to an abundance of springs.

The top layers of granite are often soft which, as around Blantyre, results in a great amount of porosity allowing storm water to percolate quickly, while elsewhere as at Zomba, the 'rotting' process has been carried a stage further, and a red clay results which is very impervious to water.

Borrow pits are common both alongside European and native dwellings from which the clay for bricks and plastering has been taken. Large borrow-pits are also to be seen along the 112 miles of railway line between Port Herald on the Shiré river and Blantyre.

Water/

Water.

Springs.

These are found in abundance throughout the highlands, and Daniels[4] calls attention to the fact that the water and damp ground at the outlets form a favourite breeding ground for anopheline mosquitoes.

I have had ample opportunity for verifying this. Very often you have small streams running through coarse 'elephant' grass where the water has a thick iron scum on the top, and only a few culices are to be found breeding there; but, dotted along the sides of such streams are small springs and at each of these anophelines will be found.

It is this factor that makes the complete destruction of anophelines in the hilly regions almost impossible, as you cannot cope with each one of these little springs.

Wells.

Made wells, brick-lined, do not usually harbour anophelines, but natural wells dug by the natives as water holes usually do.

Streams.

The country is watered by an abundance of streams running either directly into Lake Nyasa, or into the Shiré river as it runs from Lake Nyasa into the Zambezi.

The character of these streams varies greatly according to the time of year. During the hot season from the middle of August to the middle of November they/

they are very low, and they form on their course many natural pools, while leaves and branches form a super-abundance of subsidiary pools and eddies. In November and December they are often thoroughly scoured with the torrential rains, but between times they may become quiet and clear again for a week or ten days.

After that,—during January, February, and March,—the succeeding rains being more constant keep the streams running high and of a brown colour.

After the rains are over in April the swollen streams return to a very moderate volume of water coming from the perennial springs.

Besides breeding in the pools and eddies, I have observed that a common breeding place for anophelines is amongst the roots of grasses under banks, where the soil has been washed away leaving the roots bare.

Shiré River.

The Shiré river has characteristics of its own for there are two forms of vegetation peculiar to it. One form of grass growing in it has fixed roots through the interstices of which the water flows, while another grass has unfixed roots and forms large floating islands. Wherever collections of still water are to be found amongst the grasses there anophelines breed.

Lake Nyasa.

Where streams run into the Lake a bar of sand is usually found behind which anophelines breed.

Altitudes/

Altitudes.

The charts appended (Charts 1 and 2) show the elevation of the country.

Although generally speaking the lower the altitude the more intense the malaria, yet the higher altitudes are by no means exempt from it. Thus we find that Port Herald on the Lower Shiré river which is about 100 feet above sea level is very unhealthy, yet malaria is often contracted at Blantyre which is 3000 feet above sea level.

Grassi[5] records malaria in Italy at an altitude of 8,400 feet, while Craig[6] finds it in the Rocky mountains at 6,000 feet.

Local Causes.

Race.

The adult native population suffers less from the effects of the malarial parasite than the European owing to an acquired immunity which will be referred to later.

Age.

Children, especially native children, are most liable to infection being unprotected by any form of immunity.

Occupation and Social Conditions.

Europeans.

As there are no 'poor whites' in the country the surroundings/

surroundings of the Europeans should not predispose to malaria, but the appended plans will show that to a very large extent their surroundings do predispose.

Plan I. Mandala.

This plan shows the headquarters of the African Lakes Corporation Ltd. at Blantyre. It is the pioneer trading company and the leading commercial concern in the country.

It will be noticed that there are twelve European dwelling houses; that in the very centre are native quarters where there are a varying number of native children - at the time of making the plan 6 children out of nine harboured malarial parasites, while within easy flight (500 yards radius) are three streams, two of which are full of anopheline breeding grounds.

Besides this group of huts in the centre, there are other groups towards the periphery, but still within 500 yards.

In other words the conditions are such that malaria is almost inevitable, and every year I have European cases from that locality.

Plan 2. Chirimba Estate.

This plan shows the chief estate of the British Central Africa Company, Ltd. about 3 miles from Blantyre. This Company divides the trade of the country with the/

the foregoing concern, and also owns many large and valuable estates of which Chirimba is the chief.

Here we see 2 European houses with 75 huts within 500 yards, and also plenty anopheline breeding grounds within the same distance. Out of 20 native children 8 harboured parasites. Occupants of the lower house have been observed to suffer less from malaria than the upper, which is doubtless due to the breeding grounds being relatively further away.

Plan 3. Makandi.

Makandi is another important estate belonging to the British Central Africa Company, Ltd. It is about 30 miles distant from Blantyre, and has an altitude of about 2,000 feet, and is in the centre of what has come to be looked upon as a blackwater fever district. Near Makandi when the railway was being built 5 men died of blackwater fever, and at this Makandi Estate within the last 10 years no fewer than five men have contracted blackwater fever and died. On neighbouring estates one other man died of blackwater and two more suffered from it. The conditions at Makandi are therefore of special interest for it is generally held here that blackwater fever is a pernicious form of malaria.

It will be seen that here too there are all the factors favouring malaria, huts and breeding grounds being specially close to houses 2, 3, and 4. These houses are however more recent, and it was in number

1/

1 house that the fatal cases occurred.

During most of the year the Makandi stream marked in the plan as 'dry' will harbour anophelines, and the Luchenza stream is well within 500 yards.

Doubtless the altitude will tend to increase the intensity of malaria here.

Plan 4. Blantyre Mission.

At a mission station it is inevitable that there should be a certain number of young children, and this plan shows the conditions in 1914.

On each side of the mission flow two streams, and anopheline breeding grounds are plentiful. Only the houses marked with a red ring round them contain young native children.

Out of 32 of these 9 harboured parasites.

There are ten European houses, and a staff of 16 - 20 Europeans.

The average number of attacks of malaria contracted on the Station is about 1 attack in 4 years.

Plan 5. Lunzudoko Estate.

The owner of this estate is a typical small planter, and he suffered from an attack of blackwater fever in 1914. It will be noticed that his huts for workers, and anopheline breeding grounds are both close at hand to his house.

These/

These are five typical instances of how the chief predisposing cause of malaria here amongst Europeans is the nearness of dwelling houses to both native huts and anopheline breeding grounds.

Besides these five I have specially observed six other estates or stations, and at only one were similar conditions not noticeable. The one exception was an estate where there were no native huts within a good half mile of the planter's house.

It is therefore very evident that the main thing that has to be contended with is ignorance of, or carelessness about, the laws governing the transmission of malaria.

Living under poor conditions does also doubtless predispose to malaria. The early missionaries had fever regularly once a month. The incidence was also heavy amongst those engaged in such work as Railway construction, but here again it would not be so much a case of lack of resistance as the situation of the temporary camps.

Native Conditions.

The native is so well looked after by the Government with regard to food, etc. while at work on the various estates that his physical condition should not suffer at all from the very moderate amount of work that he performs.

At/

At his own home, except when there is a very occasional famine, he has abundance of food grown with very little labour, so he has thus plenty of natural resistance.

Types of Mosquitoes.

The following anophelines from Nyasaland have been identified by Theobald:-

1. Myzomia Funesta[7].
2. " longipalpis[8].
3. Pyretophorus Costalis[9].
4. Myzorrhynchus mauritianus[10].
5. Cellia squamosa[11].

Austen also mentions the following:-

6. Myzorrhynchus paludis[12].
7. Pyretophorus superpictus[13].
8. " cirereus[14].
9. Myzomia rhodesieusis[15].

I have also seen.

10. Myzorrhynchus ziemani[16].

Myzomia Funesta.

This is the variety most often observed. It is present throughout the length and breadth of the country, including the whole length of the water system, from the North end of Lake Nyasa down the Shire and Zambezi rivers to Chinde on the coast.

Breeding Places./

Breeding Places.

I have already indicated their favourite breeding places which consist of places where there is fresh water, such as springs, and at the sides of clear running streams, where pools and eddies are formed by rocks, leaves, branches, grass roots, etc. Anophelines are not found in peaty water nor where there is iron. They are also not found in borrow-pits, cattle hoof-prints, nor occasional collections of water.

Owing to the flooding of the streams during the rainy season the breeding grounds are swept away, and so there is a natural reason for the common observation that malaria is worst at the end of the rains for then the springs and pools are at a maximum, and mosquitoes can breed undisturbed.

Myzorrhynchus Ziemani.

Myzorrhynchus Paludis.

Both these varieties are frequently seen round Blantyre, and in the Shiré Highlands. Their breeding places are similar to those of myzomia funesta.

Pyretophorus Costalis.

This variety, which abounds on the West Coast of Africa, is limited in Nyasaland to the Zambezi and the lower portion of the Shiré rivers, and also to the north end of Lake Nyasa.

It is a 'wild' mosquito and does not inhabit houses very much even where abundant.

The/

The Parasite.

Craig[17], classifies the malarial parasites thus:-

Division. Protozoa.

Class. Sporozoa. Sub-class. Telosporidia.

Genus. Plasmodium.

Species. Plasmodium malariae (Quartan)

" vivax (Tertian)

" falciparum (" Aestivo-autumnal)

Of these species the tertian aestivo-autumnal (malignant tertian) is the one most often met with.

Simple tertian is only occasionally seen, and I have only seen one typical sporulating quartan rosette.

Table/

	Place	Age	Exam-ined.	In-fected	%	Full grown S.T.	S.T Gam-etes	M.T. Cres-cents	"Rings"	Quar-tan.	Enlar-ged spleen.
1.	Blantyre	1 - 14	13	2	15.4		1		1		
2.	Scott's	1 - 14	44	4	9.1				4		
3.	Blantyre	1 - 14	4	1	25				1		
4.	Chipeta	1 - 14	37	17	46	1	1	2	13		
5.	Mandala	1 - 14	127	31	24.4				31		
6.	Chigumula	1 - 14	16	5	31.2				5		
7.	Blantyre	1 - 14	14	4	28.5				4		
8.	" School	7 - 14	70	11	15.7	1			10		
9.	Mandala	1 - 14	24	6	25				6		
10.	" School	7 - 14	78	19	24.3				19		7%
11.	Lunzu	1 - 14	35	20	57.1	1	1	3	14	1	
12.	Howard's	1 - 3	54	50	92.5			3	47		40%
13.	" Factory	7 - 14	200	90	45		1	2	87		11%
			716	260	36%	3	4	10	242		

The all over percentage is therefore 36% actually observed.

Group 12 is specially noticeable showing a very high degree of infection at ages 1 - 3 years.

Group 13, Howard's factory (tobacco), in which 200 young boys and girls were employed tearing out the midrib of tobacco leaves, shows a 45% infection.

Howard's is 6 miles from Blantyre, and 500 feet higher, but the malarial incidence seems higher than in the Blantyre vicinity.

Differentiation of Parasites. Staining.

Romanowsky stain was used for all slides. These had a thin blood film covering most of the slide, and a thick blood film at one end made by spreading a large drop of blood $\frac{1}{6}$ - $\frac{1}{4}$ in. square.

The haemoglobin was first dissolved out of the red blood corpuscle of the thick films by very careful washing and, after drying, the whole slide was stained in the usual way.

By adopting this simple method a great saving in time was effected for 10 - 12 thick films could be thoroughly examined in an hour, or in the same time as 4 thin films could be thoroughly examined. If for any reason the thick film was unsatisfactory, then the thin film could be examined in its place, and, being on the same slide, no time was lost.

The/

The disadvantage of this method is that it is impossible to differentiate with certainty the various young 'ring' parasites, and I have preferred to class them together though the large majority appeared to belong to the aestivo-autumnal species. To make certain, one would have had to see all the parasites in the thin film as well, to observe if the red blood corpuscle harbouring the parasite was swollen and perhaps contained Schüffner's dots as in simple tertian, or whether it was of normal size or slightly smaller as in aestivo-autumnal fever.

When I did examine the thin film I only once saw a typical simple tertian parasite with the corpuscle showing Schüffner's dots.

A few simple tertian sexual forms (gametes 4), and adult presporulating forms (3) were seen.

As simple tertian parasites are present in the peripheral circulation at all stages of their life cycle, it follows that only a small percentage could have been infected with this form else many more would have been seen.

This does not apply to the aestivo-autumnal form, for the adult asexual forms do not normally enter the peripheral circulation.

The sexual forms (crescents) do, and these were observed on ten slides.

We may therefore conclude that in the Shiré Highlands we have chiefly to deal with the aestivo-autumnal species, only occasionally with simple tertian, and very /

very rarely quartan fever.

This conclusion is strengthened by the fact that in German East Africa where conditions are similar to here the following totals are recorded by 6 observers:-[18]

Simple Tertian	32
Quartan	16
Aestivo-autumnal	980

Spleen Rate. (Enlarged spleen).

In group 12, age period 1 - 3 years, 92% infected, the spleen rate was 40%.

In group 10, age period 7 - 14, 24% infected, the spleen rate was 7%.

In group 13, age period 7 - 14, 45% infected, the spleen rate was 11.2%.

This shows that both the infected rate and the spleen rate drop from infancy to puberty - the latter more quickly. In judging therefore in this district the amount of malaria from palpation of the spleen you require to multiply the spleen rate by about 2 for infants, and by 3 or 4 as the group age approaches puberty. It was specially to elucidate this point that I examined the 200 children in group 13.

The smallness of the spleen rate all over shows that it is impossible to discover all cases of malaria by examining the spleen only, and that the only accurate guide to the malarial index is obtained by blood examination.

It/

It was very noticeable that none of these spleens were extremely enlarged, being either just palpable or easily palpable, but never extending down to the umbilicus.

Stephens and Christophers found:-

(1) 1 - 2 years, number infected is in excess of spleen rate.

(2) Above 2 years, the spleen rate is in excess of parasite rate.

(3) Above 10 years the spleen rate is much in excess of parasite rate.

It will be noticed that the spleen rate here differs from this, for in my cases the spleen rate falls more rapidly than the parasite rate, and remains always less.

Although the spleen rate is an uncertain guide to the malarial index, yet it is useful for comparing one district with another.

Immunity.

Natural.

I have never come across a case of natural immunity, the existence of which is vouched for by Celli, Marchiafara, Bigami, and Craig[20].

Acquired.

Amongst the native population there is a considerable amount of acquired immunity, but it seems to vary greatly in different localities.

Koch, in German East Africa found adult infection/

infection nil.

Stephens and Christophers found infection of adults rare at Accra.

Arnett, Dutton, and Elliot in Nigeria found 10% above 10 years infected.

Craig found the following in the most malarious portion of the Phillipine Islands:-

1 - 5 years	72.5%
5 - 10 "	37%
10 - 15 "	24%
Adults	62%

Pleln in the Kamerun found as follows:-

Under 2	94%
2 - 5	92%
5 - 10	85%
Adults	60%

At Blantyre out of adults I found parasites in 15 cases out of 50, but this figure included many natives aged 15 to 18 years so is not conclusive.

The immunity acquired in this district is certainly not at all complete.

Grown up school-boys and school-girls on going to their homes for a holiday very often have malaria here on their return, (see Clinical Cases 17, 18, 19 and 20) and adult natives going from here on journeys where they will be more exposed to malaria than here, such as a hunting expedition - often return with malaria, or they take quinine as a prophylactic.

TREATMENT.

(1) Prophylactic.

European.

The plans shown in the previous section show along what lines useful prophylactic measures may be taken.

The primary need is to shift every native hut, or at least as many as possible, to at least half a mile from European quarters.

By this means anophelines coming to the house will seldom be carriers of malaria. It is true that there are now known to be species of migratory mosquitoes in Ceylon[21], and Colon which will fly over a mile in search of blood, but the local anophelines do not appear to have such habits. Even if they do freshly hatched anophelines will not be liable to transmit infection, while those returning to the breeding place infected, and starting out a second time will be much less likely to light on a European's house if it be 800 yards away from the source of infection than if it were close at hand.

How can residents be induced to take such precautionary measures?

By a Publicity Campaign.

With a view to arousing interest in the subject I sent the appended letter[A] to the Nyasaland Chamber of Commerce and Agriculture, which includes nearly all the/

the planters and traders in the country, or their representatives. In it I pointed out the conditions existing which I have already mentioned, showing how dangerous they were to the health of the community, and how great improvement could be effected by segregation.

The Committee recommended my suggestions to its members and had my letter printed in the local press in which a favourable 'leader' on the subject appeared.[B]

To further keep the matter before planters and estate managers I sent out the appended letter.[C]

The analysis of the answers is as follows:-

48 replies were received with regard to the nearness of native huts.

Of these (A) 32 had huts within ¼ mile.

(B) 8 " " " ½ mile.

(C) 8 " no huts " ½ mile.

Of the 40 (A and B)who had huts within ½ mile

27 had power to move them.

13 " no power " " "

Of the 27 who had power to move them

14 intended to do so.

13 did not intend doing so.

The answers with regard to the taking of quinine may also be noted here:-

A. 27 residents out of 72 take quinine prophylactically regularly.

Dose/

Dose. 15 take 5 gr. daily.

4 take 15 gr. twice weekly

8 take from 10 to 30 gr. per week.

Average stay in country 11 years, average use of quinine prophylactically, 6 years.

Result. 11 (40%) = no fever.

9 (33%) = 3 attacks or less

7 (27%) = over 3 attacks (all slight)

B. 29 residents take quinine prophylactically occasionally when feeling as if fever were coming on.

Average stay in country 12 years.

3 (10%) = no fever.

6 (21%) = 3 attacks or less.

20 (69%) = over 3 attacks.

C. 16 residents only take quinine when actually attacked by fever.

Average stay in country 9 years.

2 (13%) = no fever.

6 (49%) = 3 attacks or less.

8 (47%) = over 3 attacks.

It should be noted that the previous history of Class A when prophylaxis had only been started after a few years residence in the country was invariably bad:- "Once a fortnight." "On every occasion." "Very many.' "200 attacks." "3 attacks blackwater", etc.

These tables clearly show the benefit of prophylactic/

prophylactic quinine, indeed those living in malarious districts, and therefore obliged to take quinine, evidently suffer less from malaria than those living in slightly malarious districts and who do not protect themselves in this way.

I append[D] the most interesting and instructive letter in answer to my queries. The writer having lived 21 years in the tropics and being the son of a medical man describes his experiences very clearly.

(2) By the appointment of a Medical Officer of Health for Nyasaland.

It is too much to hope for that much general and permanent good can be effected by such means as the above alone.

The colonisation of the country being a desideratum from the Government's point of view, they should make a real endeavour not only to look after the health of their own officials, but also the rest of the community, at least as far as the prevention of malaria and kindred subjects is concerned.

As most Missions have their own medical officers, this would only mean advising the 300 or so people who are neither connected with the Government nor Missions. Each new arrival in the country should receive a pamphlet, either such a one written by Ross - Summary of Facts Regarding Malaria (2d) - or, preferably, one written by the Principal Medical Officer here in which local conditions can be more fully detailed containing specific/

specific directions as to the importance of segregation, the best method of using Quinine prophylactically, along with a clear statement of the life cycle of the malarial parasite.

At the same time an offer of skilled advice should be made in the event of the recipient being settled on a plantation, both with a view to his own health, and that of the natives under his care.

At present a European may go into the Government Hospital at Blantyre, or Zomba, suffering from malaria or blackwater fever, and afterwards he will be sent home again without his home conditions being examined to see if there be any precautions that might be taken in future. The chief reason is that the Government Medical Officer has no time for this work, and also that the planter or trading company may not realise that it is worth their while paying for the Medical Officer from £3: 3/- to £5: 5/- for such advice.

To carry on such work it would therefore be necessary for the Government to appoint a whole time Medical Officer of Health for this work.

I need scarcely say that there is scope for such a medical officer in other public health matters besides malarial prophylaxis especially with regard to dysentery, aukylostomiasis and schistosomiasis amongst both natives and Europeans, also tuberculosis and venereal diseases which are being allowed to spread amongst the natives quite uncontrolled.

The advent of the motor-cycle and improved roads would/

would allow of one medical man covering an area which would have been quite impossible a few years ago when a 'machila' - or hammock - was the only means of progression.

Prophylaxis in comparatively healthy areas.

In a place such as Blantyre where the malarial incidence is slight, where blackwater is seldom or never contracted, and where mosquitoes are never seen in great numbers, it is difficult to maintain prophylactic measures.

In 12 years I had 3 attacks of malaria, and this is about the average amongst our staff of 19 whites - one attack in four years.

The same applies to the Blantyre European community of about 120 individuals. This low rate makes the majority of people unwilling to take quinine regularly as a prophylactic.

If segregation were properly carried out I believe that the incidence of malaria could be reduced to a vanishing point, and endeavours are being made along this line.

At Mandala, Plan 1, the children in the centre where there are brick native quarters are being systematically dosed with quinine to keep parasites out of the peripheral circulation, or to destroy them, while all movable huts have been shifted to over ½ mile away.

At the Mission here a similar course is adopted - all/

all unnecessary huts shifted to half a mile away, and the children in all necessary huts or houses dosed with quinine systematically.

Mosquito Destruction.

Although the complete destruction of all anopheline breeding grounds is almost impossible for reasons already stated a great deal can be done to diminish their number.

Here (Blantyre Mission) we have an ordinary native labourer who attends to a certain section of the streams around the Mission each day so that he finishes his round in one week. This does not give the larvae time to breed out. His work is to keep the water running freely in places where grasses grow by ditching, to fill up little side pools, to remove branches and leaves forming pools, to cut the banks flush and so prevent the anophelines breeding amongst the grass roots, and to sweep down stream all larvae that he finds.

His wage is 6/- a month. A hospital boy goes over his previous day's work to see that it is properly done.

This is the chief difficulty for the ordinary labourer is apt to spend his time at spots where there are no anophelines breeding, and the native inspector in turn needs some one to keep him up to his work.

By these means however the breeding places have been reduced from hundreds to dozens.

A/

A similar plan has been adopted at Mandala.

In small communities such as the Blantyre Township the giving of quinine to natives living in its vicinity should not be left to private individuals, but should be one of the duties of the native sanitary inspector who is already employed by the Town Council for general sanitation work.

In 1911 the Government Medical Officer sent round a circular advising everyone to give quinine to their native servants, and their servants' children; but if the average European cannot be bothered taking 5 gr. Quinine daily himself, it is not likely he will put himself to the trouble of forcing quinine down the throats of the unwilling and protesting children of his house-servants. This work should be entrusted to a trained native working under the Government Medical Officer who has a seat on the Town Council at present.

Protection from Mosquitoes.

Mosquito proof houses are unnecessary where there is only a slight amount of malaria, and even if provided are not properly used, for, the danger being so slight, doors are left open indiscriminately. There is one in Blantyre with the verandahs all properly screened in - but the verandah doors stand open regularly.

Mosquito nets should of course be used, though some do without them.

Prophylactic Quinine.

In comparatively healthy areas where you may go 3 or 4 years without being infected it is needless and hopeless to induce everyone to take quinine prophylactically. In cases of pregnancy I always recommend gr. 5 Quinine to be taken daily as I believe that it is the malaria and not the quinine that causes abortion when malaria complicates pregnancy; though of course quinine usually gets the blame - and the practitioner! In those special cases where people get malaria once a year or oftener, it is not difficult to induce them to take quinine while the general community do not.

Moderately Healthy Areas.

Scattered over the Shiré Highlands we find isolated plantations the owners of which are engaged in various planting operations, coffee, tobacco, rubber, cotton, tea, etc., and as these grow best at a slightly lower level than Blantyre, we find malaria more frequent, and often associated with blackwater fever.

Prophylactic Measures.

(1) Segregation. This can be most easily carried out on such estates for the manager has everything under his own control, and can place his house and his workers' huts where he likes.

The usual reason for the huts being placed near to the planter's house is that they may be under his eye,/

eye, and also that no time may be lost by the man dawdling up to roll-call in the morning.

These advantages are however more than counter-balanced by the greater liability to malaria incurred thereby.

At all the estates I visited personally I found the managers most willing to fall in with my views and agree to shift their huts, and I am convinced that all that is needed is the friendly advice of a Government Medical Officer of Health to have this done throughout the country.

From a humanitarian point of view and also to circumvent 'migratory' mosquitoes, should such be a danger, it would be well to have a trained hospital assistant on each estate, or group of estates, who, amongst other duties, would give quinine systematically to the workers' children.

(2) Prophylactic Quinine.

Unless segregation is perfectly carried out Quinine gr. 5 should be taken daily, especially if the planter visits other estates on week-ends where the same precautions are not observed. The letter[D] already referred to brings out the importance of this point.

Mosquito proof houses are beyond the means of an ordinary planter.

(3) Unhealthy Areas.

Certain localities have a well merited reputation for unhealthiness, due to pernicious forms of malaria, especially hyperpyrexia and blackwater fever. Chiromo and Port Herald on the Lower Shiré river are the best examples of this.

Here climate is the main predisposing cause, for there are about 7 months in the year when the temperature varies between 85° F. and 118° F.

As the residences at these places are entirely the houses of Government officials, and agents for trading companies, they should be mosquito proof throughout, for such a trying climate predisposes to the neglect of other precautions, and therefore those forced to live in such places should be protected from themselves.

At the same time of course, the taking of prophylactic quinine and segregation should be attended to.

One year should be the maximum time spent for the first term in such localities subsequent terms may be increased to 2 years should it be found that the person stands the climate well.

Natives.

The only prophylactic measure applicable to the native population at present is the giving of Quinine to school children. I cannot however myself see the value of such a measure for the average child of school age/

age does not suffer from malaria although he has parasites in his blood; at least that is my experience here where, as already noted, only a small percentage of spleens are enlarged, and these only moderately.

To interfere with the immunity that is being acquired without ill result to the child can only leave him more liable to malaria when he grows up and ceases to have quinine given him. Besides this the school session is only for 7 months, and the average attendance is a good deal less than this, so that to give quinine prophylactically would mean the spending of a great deal of money with very little result. A far larger percentage of children below school age harbour parasites, so the keeping of malarial parasites out of the blood of even the whole 97,000 scholars for 7 months of the year would have no appreciable effect on the health of the rest of the population, and very little on the children themselves.

The giving of quinine in schools by way of curative treatment is of course another matter and will be dealt with later.

I notice[22] that free quinine is given to Government school children in Southern Nigeria - cost £39.

In Perak[23] schoolmasters give Quinine to all children with enlarged spleens.

In Pahang[24] about £100 quinine is distributed free.

In/

In Algeria parents, or schoolmasters, are required to give children between 3 - 10 years 3 grains daily.

Gambia[25] spends £50 on school quinine.

Ceylon[26] gives free quinine in schools.

Conditions here are however absolutely different, for it would cost no less than £5000 to give the total (97,000) number of scholars 3 grains of quinine daily for 7 months only in the year, so it is hopeless even to think of such a method unless the results bore some relation to the outlay.

Curative Treatment.

Europeans. My ordinary routine treatment is to give 20 grains of Quin. Bisulph in divided doses in solution until the patient's temperature is normal for 24 hours, after which 15 grains is taken for a day, and then 10 grains for 10 days, and after that 5 grains for a month.

The 20 grains is given in divided doess at 7, 9, 11 a.m. and 1 p.m. Often when called in vomiting is present, if so quinine need not be pressed at once, as long as 15 or 20 grains are given before the next paroxysm, and 2½ gr. doses may be given if 5 grain doses cannot be retained.

As tetanus is apt to follow upon deep injections of quinine owing to the necrotic area forming a suitable nidus for the growth of the bacillus, which does not need to enter at the seat of injection but at some/

some other abrasion, I have discontinued the routine injection of quinine when vomiting persists, for in my cases it has always been possible to give the necessary amount of quinine sometime within the 48 hour cycle. In cases of double tertian fever showing a quotidian rise of temperature it might be necessary to resort to this method, or to give it by the rectum.

A typical case of aestivo-autumnal fever becomes finally normal on the 7th day under the influence of quinine. The temperature usually rises for the second time on the 3rd day, and again a rise takes place on the 5th day, but by the 7th day the quinine has got the parasites quite 'under', and no further rise takes place.

Patients must be kept in bed for 24 hours after the temperature is normal, to give time for a rise to take place if it is going to occur. Severe results arise from patients treating themselves, and getting up to work on the first morning that their temperature is normal.

I need not enter into further details of treatment of European cases for the general line of treatment is well known, and pretty constant in result.

The prevention of relapses is of course very important, and it is unfortunate that so many people treat themselves with inadequate doses of quinine, and so keep the actual fever under rather than cure the malaria./

malaria.

The popular idea that a cold bath, extra exertion, etc., brings on fever clearly shows the large number of imperfectly treated people in the country, who suffer from relapses when some exciting cause arises.

Dr James[27], states that small doses (4 gr. daily) of quinine have no effect on relapses, and this will account for the apparent failure of this amount in some cases to act as a prophylactic, the patient having already malaria in his system, and suffering from relapses and not fresh attacks.

Natives.

Adults. Adult natives react to quinine very promptly, and 10 gr. of quinine given morning and evening usually brings down the temperature on the 4th or 5th day without further rise. I have never seen any pernicious forms of malaria in adult natives, and even vomiting is rare.

Ten grains given daily for a week after the attack is sufficient to prevent relapses.

Natives are beginning to appreciate the value of quinine and buy it readily - it is the drug that must most strictly be kept under lock and key, which is a sure test of its popularity.

Children/

Children. I have made a special study of the giving of quinine to children and its results, and my clinical cases will deal chiefly with this aspect of treatment.

In the out-patient department here the treatment of children for malaria and other diseases has been rather unsatisfactory owing to the irregular attendance of the mothers, and lack of staff to follow up the cases in the patient's own homes in the surrounding villages.

I have however recently endeavoured to follow up all cases presenting themselves, and noting the effect of quinine on the temperature, and on the parasites in the blood.

How to give quinine effectively to children from 6 months to 3 years - who are most heavily infected with malaria is the main problem.

(1) Quinine in Castor Oil.

For first visits to the dispensary it is usually best to give 2 - 4 gr. quinine in 1 - 2 drachms castor oil, it being no more difficult to give castor oil with the quinine than without.

(2) Quinine Tannate with Chocolate Basis.

Messrs Burroughs Welcome & Co. made up for me 5 gr. tabloids of Quinine Tannate with a chocolate basis for children (5 gr. Quin. tannate has about the same alkaloidal strength as 2 gr. Quin. Sulphate).

Having/

Having tried about 2,000 of these tabloids on children I find that the taste of Quinine is well disguised, and that children, from two years upwards, take them readily without objection.

Below that age it is difficult to get children to suck them. The main objection to tabloids is that they are dear, costing $\frac{4}{10}$ d. each at home, and representing 2 grains of quinine sulphate, while 5 gr. tabloids of quinine sulphate, or bi-sulphate cost $\frac{2}{10}$d at home; so the quinine value is less than half, and the cost is double. Their advantage is of course that they are convenient for giving out to native parents, and the practical certainty that children above 2 years will consume them. I have only had one case where a child vomited them and the following mixture had to be substituted.

(3) Quinine in syrup and mucilage.

This is the form of administration that I now favour. It is very much cheaper than quinine with chocolate basis, and I find it is taken readily by children of all ages. It is made as follows :-

Simple Syrup 3 parts

Mucilage of Tragacanth 1 part

Quin. Bisulp. Q. S.

It is made up in strengths of

1 drachm $\dot{\bar{I}}$ = 2 gr. Quin. and

1 drachm $\dot{\bar{I}}$ = 4 gr. Quin.

The cost is 1d for 8 drachms of 2 gr. Quinine to 1 drachm./

drachm.

The taste of the Quinine sulphate or bi-sulphate is sufficiently disguised to allow children to take it readily.

Dose.

The dose given is approximately 1 gr. of Quinine bi-sulphate for each year of age given twice a day while fever continues, and thereafter once a day for a fortnight when possible.

The charts of the clinical cases show that such treatment results in the speedy reduction of temperature and disappearance of parasites.

At present our efforts should be directed towards the treatment by quinine of young children in whom malaria is causing fever, diarrhoea, vomiting, etc., and of older children if their spleens are distinctly enlarged, and at the same time they show signs of malnutrition.

Educated natives should be encouraged to keep quinine in their houses so that on the first symptoms of malaria quinine may be given; this is especially desirable in the case of children, in whom pernicious symptoms speedily arise, especially the comatose form.

At present all the teachers (36) in training at the Blantyre Training Institution here while in Standards IV, V, and VI receive instruction in Physiology Bandaging and First Aid, and Lectures on Common diseases/

diseases of the country. Special attention is paid to malaria.

Most of these teachers are in charge of, or employed at, out-schools for at least 3 years after being trained, and supervise district dispensaries for the dispensing of quinine and simple remedies, and also for the dressing of ulcers and wounds.

The value of quinine is now well known, and as, except in time of famine, there is no real poverty in the country, the natives are quite able to pay for quinine used curatively.

Quinine bisulphate tabloids gr.5 can be sold at 4 a penny, so that from sixpence to ninepence worth will effect a cure in an adult, and, as the sugar and tragacanth in 1 lb. of Quinine in syrup mixture only costs threepence, sixteen 2 gr. doses of quinine in 1 drachm of syrup and mucilage will cost only twopence.

By putting this mixture into 1 oz. bottles of drachm doses it can be sold to natives at one penny a bottle. (bottle to be returned.)

On the other hand an equivalent quinine value of chocolate quinine would cost eightpence for 16 doses, so it would be quite unsaleable.

The time may come when there will be a combined assault on malaria by every available means but half measures are doomed to failure.

CLINICAL CASES.

Cases 1 - 25 (except cases 20 and 24) are a group of consecutive native cases seen in the hospital and dispensary.

1 - 8.

This group of children shows rapid response to quinine, and the complete disappearance of parasites from the peripheral circulation. The temperature was taken continuously up to the last date mentioned when "No parasites" were found.

Symptoms. The history given is almost invariably the same - feverishness at night, headache in the older children and sometimes pain in the bones, diarrhoea and sickness in the case of the infants. Cases 4 and 7 show a return of fever because the patients did not return to the dispensary - after this quinine was given in their own homes.

The quickness with which the fever responds to quinine is noticeable - 4 days being the longest time taken for the temperature to become normal.

Treatment.

1 gr. Quinine bisulphate, or gr. $2\frac{1}{2}$ Quin. Tannate, for each year of age was effectual in these cases.

9 - 16.

This group consists of cases where the temperature responded to quinine but where parasites remained in the/

the peripheral circulation after a fortnight or three weeks of treatment, although they disappeared when treatment was continued for a fortnight longer.

Case 12 showed no parasites in the peripheral circulation, but they were doubtlessly present in the visceral.

Case 10 shows a relapse, the quinine having been stopped too soon.

Cases 11 and 14. Considering the ages, 14 and 13 years, quinine gr.5. was too small a dose, though it eventually caused the disappearance of the parasites.

This list of cases taken in conjunction with the previous one shows that giving 1 gr. Quinine bisulphate, or $2\frac{1}{2}$ gr. Quinine tannate for each year does not always cause the immediate disappearance of parasites, so that twice that quantity should be given in divided doses if possible.

Cases 17 - 23.

These are cases of malaria in adults.

Symptoms. The symptoms are never distressing - headache, pains in bones, chilliness and fever are complained of, but do not cause prostration, and there is no vomiting.

17, 18, 19, 20.

Four cases showing that immunity to fever amongst adults is by no means complete.

These two boys and girls left here and went to their/

their homes for a fortnight. On their return they attended the dispensary here complaining of the above symptoms.

Course. It will be noticed that the temperature responded at once to quinine bisulphate gr. X given once or twice daily, and that no parasites were found when the blood was afterwards examined.

21, 22, 23.

Ordinary cases of a mild type.

Cases 24 - 25.

Two cases of malaria showing pernicious symptoms.

Case 24.

History. Patient was ill for 3 days before admission with pain in head and abdomen and feverishness. Motions loose, but showing no blood nor mucous. Spleen palpable. Parasites observed in blood on Oct. 8th and 9th. Patient admitted to hospital but removed by mother on Oct. 12th. Patient re-admitted on Oct. 16th with meningeal symptoms.

Date 17/10/14. Head markedly retracted, child very restless and irritable. No strabismus, no spasticity of leg muscles. Unable to swallow.

Nutrient enemata were given every 2 hours, and Quinine Bisulphate gr.5 given twice daily by rectum and retained.

Date 18th and 19th Oct. Treatment continued as above but though temperature fell the patient died without recovering consciousness.

Case 25.

History. Patient ill for one day before admission, complaining of fever and headache. Following morning she became comatose, and was brought to hospital and admitted.

Symptoms. Patient was unconscious and had double squint to the right; was able to swallow liquid quinine and fluids. Numerous parasites in blood.

Treatment. Quinine Bisulphate gr.3 was given in solution twice daily, and after 24 hours patient recovered consciousness, meningeal symptoms disappeared and patient made a quick recovery.

Note. A year previously I treated this girl's elder brother for a similar attack of fever. I found him quite unconscious in his village and unfit to be moved. He was able to swallow quinine and fluids.

The following day he was admitted to hospital where he remained unconscious for three days, but afterwards he made a complete recovery.

SUMMARY AND CONCLUSIONS.

European.

The Country.

Nyasaland is at present not a white man's country in the sense that adults and children can live and be brought up here and yet preserve the same health and vigour as in colder climates. This particularly refers to where the bulk of the population is situated, namely in the Shiré Highlands at an elevation of between 2,000 and 3,000 feet on the higher plateaux to the West, with an elevation of 4,000 feet upwards, there seems to be little reason why it should not be equally healthy, though a warning note comes from British East Africa where, at a similar altitude, settlers are found to be specially prone to nervous complaints.

It is a much discussed point at present in all our tropical possessions whether or not white people can colonise successfully in the tropics if tropical diseases were eliminated. Certainly the elimination of malaria would be a great help towards making this country permanently habitable by the white population.

The present Position.

The lack of proper segregation even where possible, the heavy infection of native children, and the presence of anophelines wherever there is the smallest spring or clear running water, makes the outlook none too/

too bright if no further advance is made in coping with malaria. The present position is however a great advance on that of 20 years ago when there was a blackwater fever incidence alone of 11.6 per cent, and sixteen people died from this disease out of a population of 275.

The average incidence is now only 1 per cent so it is no longer sufficiently prevalent to induce the community to take further anti-malarial measures on any extensive scale.

As long as the three links in the malaria infection chain exist - infected children, anophelines, and European dwellings within easy mosquito flight -, so long will malaria persist as at present: break any link completely and malaria will stop; weaken any link and malaria will diminish.

By segregation we can almost break one link completely, by quinisation of native children in the vicinity, and the reduction of anopheline breeding places, we can weaken the two other links.

What can be done along these lines has been considered, and it is evident that much could be effected under the constant supervision of a Medical Officer of Health for the country.

Natives.

The curative treatment of malaria amongst the natives is distinctly encouraging. Comparatively small doses are required, the cost of which is not beyond the native's means. Quinine is a popular drug, and the natives fully recognise its benefit. The absence of vomiting and pernicious symptoms (except in the case of some children) allow of the successful home treatment of this disease without medical supervision.

The chief thing is to bring facilities for obtaining quinine within reach of all, and this can be done, generally speaking through the village schools of which we have 80 in the Blantyre district alone.

To have it done effectively in all districts this too would need to be under Government control.

The native hospital assistants being trained here and at the Livingstonia Mission, could be employed in supervising quinine dispensaries in the district to which they are attached, the teacher in charge doing the actual selling and getting a commission on sales.

Such work should be initiated by the various mission societies, and when the feasibility of it is proved the Government might be persuaded to take it up. At present the Medical Department in the Administration has not much power for the Principal Medical Officer has neither a seat on the Legislative Council nor/

nor on the Executive which is a decided fault in a tropical Colony.

If we can continue to popularise quinine amongst the natives, and educate the rising generation as to the nature and transmission of malaria, then we are doing a great deal to prepare the way for a combined assault on malaria, at some future date, so that it may be finally eradicated or reduced to sporadic cases instead of being endemic.

B I B L I O G R A P H Y.

1. History of Greek Therapeutics and the Malaria Theory.

2. Report on the Work of the Greek Anti-Malarial League - Annals of Trop. Med. and Parasit. Vol. II, No.2

3. Factors in the Transmission and Prevention of Malaria in the Panama Canal Zone - Ibid. Vol. IV, No.2.

4. Report of Malarial Commission of Royal Society No.V, p. 28.

5. Craig. Malarial Fevers, p.105.

6. " " " p.106.

7. Monograph of the Culicidae of the World - E.V. Theobald Vol.V. p.17.

8. " " " p.20.

9. " " " p.40

10. " " " p.53.

11. " " " p.70.

12. Austen's Monograph of the Culicidae, p. 131.

13. " " " p. 153.

14. " " " p. 163.

15. " " " p. 191.

16. Stephens & Christophers, Study of Malaria, 3rd Edition, p.170.

17. Craig, Malarial Fevers, p.18.

18. Deadrick, Malaria, p.34.

19. Stephens & Christophers Malaria, p.212.

20. Craig. Malarial Fevers, p.94.

21/

21. Transactions of the Society of Tropical Medicine and Hygiene, July 1914.

22. Journal of Tropical Medicine, 15.2.12.

23. Trans. of the Society of T.M. & H. May 1, 1911.

24. " " " June 1, 1911.

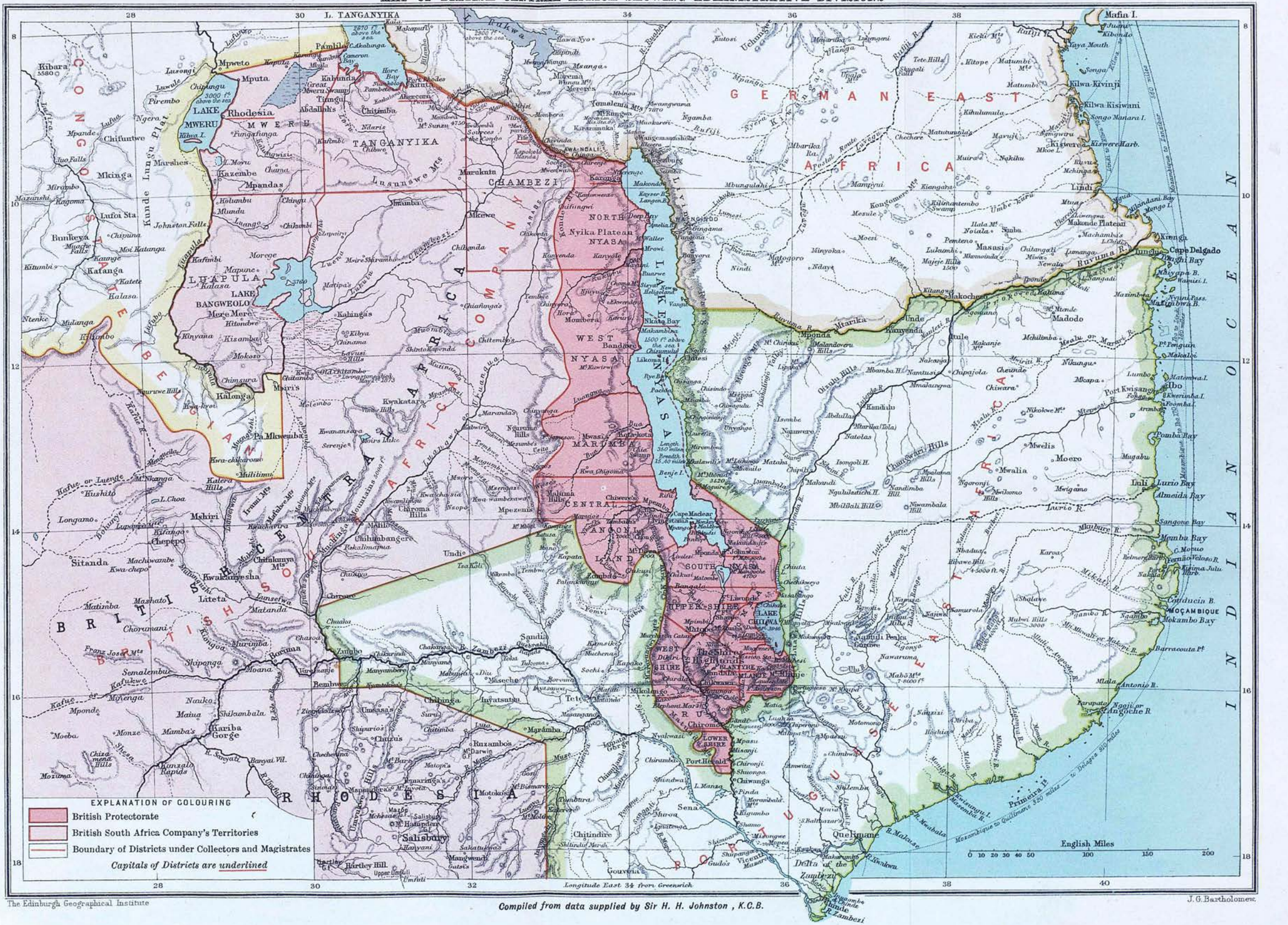
25. " " " May 1, 1912.

26. " " " Nov. 1912.

27. Craig, Malarial Fevers, 3rd Edition, p.80.

Map 1

MAP OF BRITISH CENTRAL AFRICA SHOWING ADMINISTRATIVE DIVISIONS



The Edinburgh Geographical Institute

Compiled from data supplied by Sir H. H. Johnston, K.C.B.

J. G. Bartholomew.

Map B 2A

A MAP OF THE SHIRE HIGHLANDS

COMPILED FROM THE SURVEYS MADE BY
Capt. Sclater, R.E., Sir Harry Johnston, K.C.B.,
Mr Alfred Sharpe, Lieut.-Colonel Edwards,
and the Surveyors of
The British Central Africa Administration,
with additions from the Maps of
Mr Oscar Beringer, M.I.C.E.
1897.

Scale of English Miles
1 0 2 4 6 8 10

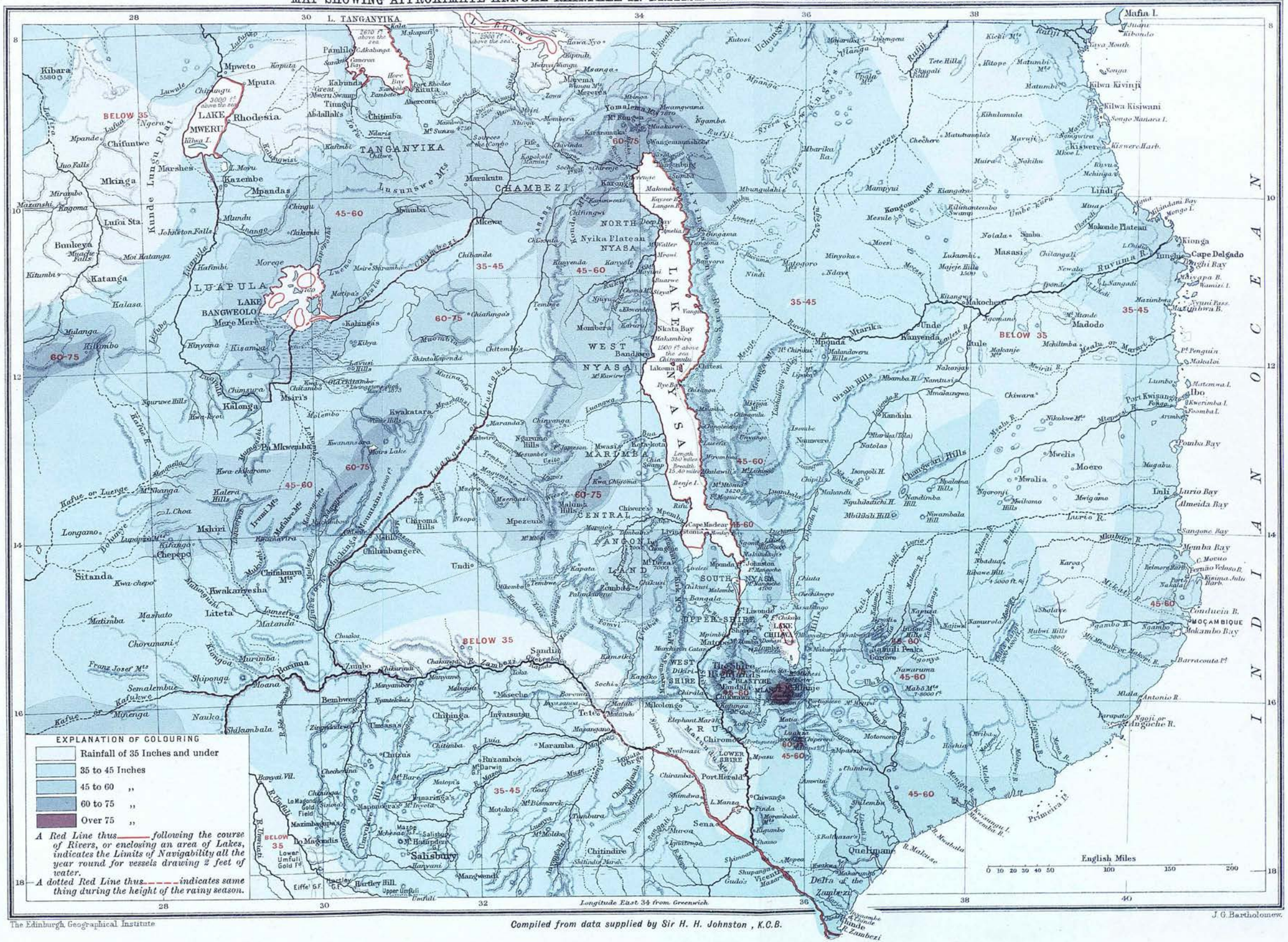
EXPLANATION OF COLOURING

	Above 9000 feet.
	8000 to 9000 feet.
	7000 to 8000 ,,
	6000 to 7000 ,,
	5000 to 6000 ,,
	4000 to 5000 ,,
	3000 to 4000 ,,
	2000 to 3000 ,,
	1000 to 2000 ,,
	500 to 1000 ,,
	Sea Level to 500 ,,

The Edinburgh Geographical Institute

J. G. Bartholomew

MAP SHOWING APPROXIMATE ANNUAL RAINFALL IN BRITISH CENTRAL AFRICA & ADJOINING COUNTRIES



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Compiled from data supplied by Sir H. H. Johnston, K.C.B.

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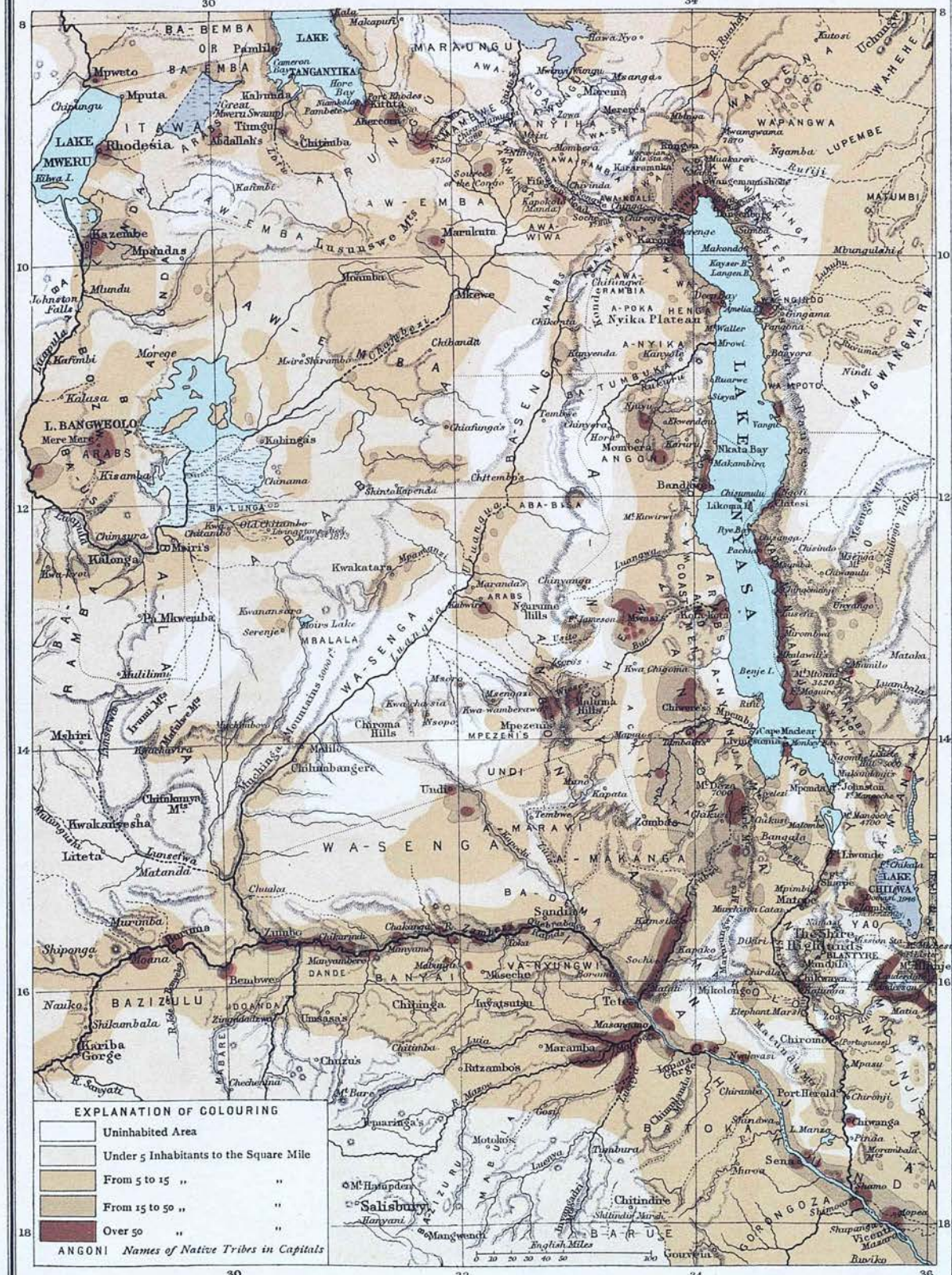
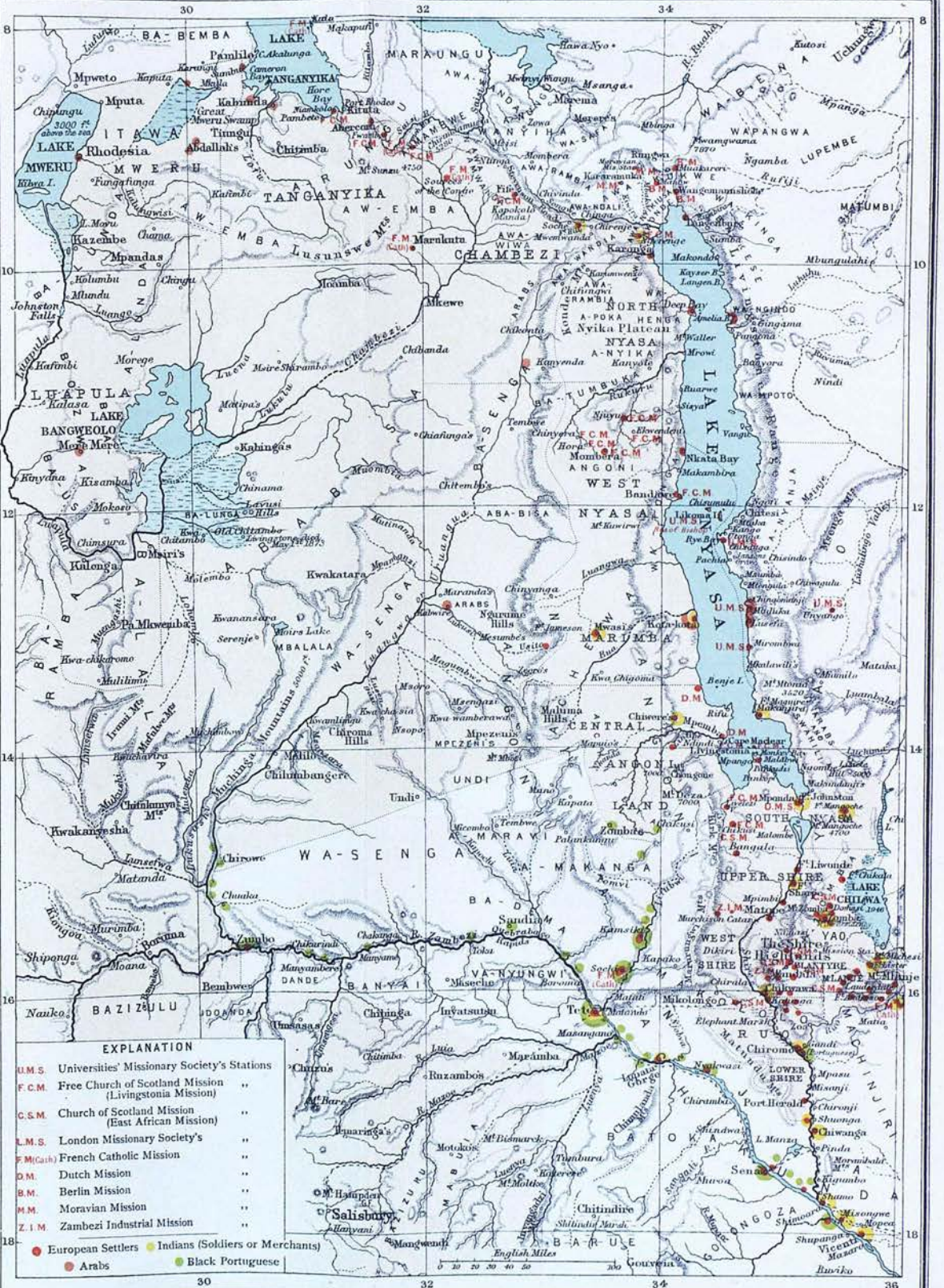
MAP OF BRITISH CENTRAL AFRICA SHOWING DENSITY OF POPULATION AND DISTRIBUTION OF NATIVE TRIBES



MAP OF BRITISH CENTRAL AFRICA SHOWING MISSION STATIONS & FOREIGN SETTLERS



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J. G. Bartholomew.

the future.

MALARIA

We direct the notice of our readers to a letter written by Dr. Caverhill of the Blantyre Mission to the Secretary of the Chamber of Agriculture and Commerce and which we reproduce in another column. There is no doubt that the general health of the European community is much better now than it was say twenty or even ten years ago. This betterment is due to many causes but one of the chief causes is the advance which Medical Science has made in the treatment, and, more important still, in the prevention of malaria. Prevention, as we all know, is better than cure and there is no doubt whatever that Malaria and Blackwater fever are preventable diseases. There is no reason why anyone should have malarial fever if the community as a whole could be induced to take the proper steps to prevent infection. This of course is a counsel of perfection under the circumstances which obtain in Nyasaland but at the same time, especially on Estates, a great deal can be done to reduce the risk of infection to a minimum. On most estates all the factors are under control and we hope Dr. Caverhill's advice will lead to a great deal of attention being paid to the subject with consequent benefit to the health of the residents on Estates. It may be pointed out that a person may at once carry out all the instructions contained in the letter and in other medical articles on the subject and still have fever. This is not to say that the precautions are ineffective. It only argues that the old malarial infection still persists and may break out now and again as we all know from the fact that people may have malaria in Europe years after they have left this country when all possibility of re-infection has passed, away. As a rule however if the re-infection is stopped, and especially if quinine is taken for some time after the precautions against infection are instituted, there will always be a progressive diminution of the risk of fever and in many cases practically complete immunity will obtain. It must not be forgotten however that when one travels into districts and places, especially where there are many natives, where the precautions detailed are not observed one is apt to get re-infected to a considerable degree, hence the necessity for everyone joining in the campaign against malaria and doing their best to make it safe for themselves and the community generally. Government might do much in the way of keeping native huts away from mosquito infested places and there is room for a good deal of improvement as regards the sites of native villages. This can only be done gradually and by the diffusion of knowledge on the subject. Meantime the Europeans have themselves largely to blame if they do not free their dwelling places from the noxious pest which leads to so much ill health. Dr Caverhill deserves the thanks of the community for again bringing before them the means whereby we may avoid malarial infection.

Estate Sanitation.

MALARIA.

I took occasion to visit, before the rains, ten small communities and estates to study the conditions favouring malarial fever. As the results of this small enquiry may be of practical interest to your members (Chamber of Agriculture and Commerce) and members of District Associations, I bring them before your notice.

The two all-important factors in the production of malaria are the presence of anopheline mosquitoes, and the presence of persons having malarial parasites in their blood, for without these infected persons the bite of even an anopheline mosquito would be harmless.

It has for many years been an established fact that the persons who habitually harbour malarial parasites, often without any symptoms of fever, are native children from infancy to puberty.

It has also been ascertained that the normal flight of the mosquito does not exceed 800 yards.

These last two facts give us the key to the prevention of malaria in the localities I visited, and I expect generally throughout the Shire Highlands, namely, that no native huts where there are children should be allowed within 800 yards of European dwelling houses

In nine out of the ten places examined I found native huts within 400 yards, and often within 200 yards of European houses, and about 50% of the children living in these huts were found to be harbouring malarial parasites, and as anopheline larva were always to be found in the springs and streams near at hand, everything was favourable to the transmission of malaria In two of the localities blackwater fever had occurred.

It means a certain loss of time having the workers huts 800 yards from the dwelling house, and it may be necessary to have a few huts remaining at close quarters, but taking everything into consideration I am sure that it would be worth while for individuals and Companies to adopt this method of segregation as completely as possible.

During the coming dry season it should be easy to select sites for huts outside a range of 800 yards from European houses, and so without any additional cost whatever, utilise one very important safeguard against malaria and blackwater fever.

The alternative method of getting rid of the anophelines in most cases would be a very difficult and costly procedure, though where practicable it would have the advantage of protecting the native as well as the European community.

These facts are of course not new, but merely the re-statement of the conclusions of Drs. Stephens, Christopher, and Daniels, following their work here and in West Africa, which have either been forgotten or never acted upon.

A. M. CAVERHILL.

Swamps and Mosq... Livingstone Colle...

Dr. Caverhill

Mission Hospital

Blantyre

D

NJULI ESTATE,
CHIRADZULU DIST.
BLANTYRE.
I2th.June 'I5.

Dear Dr. Caverhill,

I have received your circular letter on the subject of Quinine as a prophylactic against malaria, and if you will permit me to answer it in my own manner instead of just answering the printed question I think I may be able to give you some information as regards my own experience in the matter which will be of interest to you. I will however use the printed questions as a guide to me, so that I may give you the information you require.

I have lived in malarial countries(with the exception of an occasional visit to England which however never exceeded six months on any one single occasion) for the last twenty one years.

In I894 I went out to British Guiana and remained there in various capacities until May I899. While there, I did not take any quinine as a prophylactic measure. I got fever on one or two occasions and was treated for it by my father, the late Sir David Palmer Ross who was at the time Surgeon General of that Colony. No one, as for as I am aware, ever took quinine as a phophylactic in those days(Sir Ronald Ross not having yet come to the fore with his mosquito theory). When we got fever we were dosed with quinine until it went away and after a week or so the dosing was stopped and we went on like that until the next attack.

In I899 I received an appointment in the Government Service of the Gold Coast Colony and immediately on my arrival there was sent to take charge of one of the Districts on the Volta river. While there I had several attacks of fever, some slight and some very serious; in fact on one occasion I very nearly died. Just about the time of my being due for leave, after twelve months residential service, I first heard of the mosquito being the cause of malaria. The majority of the 'Old Coasters' scoffed at the idea and some of them even went so far as to abandon their nets to prove how ridiculous it was. A good many deaths resulted from this to my certain knowledge. Ten out of the eleven Officials stationed at Salt Pond died ~~died~~ at exactly that time. We were then circularised by the Government explaining the mosquito theory and advised to take quinine regularly to arrest development of fever after having been subjected to mosquito localities, which of course the whole Colony was.

I may say that I was also one of the scoffers, but as soon as I heard of the Salt Pond episode, I got an attack of what was called 'Funkitis Africanus' and commenced taking quinine regularly like a lamb. I can positively state that as long as I kept this up, without a break, I never got a single attack, and further; after seeing scores of fever cases, I have never yet met a single patient who could conscientious-ly say he had not got careless in taking his prophylactic doses.

In all, I remained on the Gold Coast eight years, and in that time I must have swallowed pounds of quinine. Whenever I got careless about taking quinine, I got fever and on one occasion I got a slight dose of blackwater. In I908 I was invalided from the service through chronic cranial neuralgia, but was, after being at home some little time, sent to this Country where I was stationed at Blantyre as Asst. Resident.

My quarters at Blantyre were anything but healthy ones, being down on the golf links and near the Mudi stream. Soon after my arrival, thinking this country a health resort after the one I had left, and taking therefore no proper precautions, both I and my wife went downwith smart doses of fever. We took quinine regularly after this, and so long as we continued to take prophylactic doses we were free, but getting careless later on, because of the absence of mosquitoes in the colder weather we both got it again.

After twenty months of Blantyre I was transferred to Chikala as Resident, and arriving there in June found no moaquitoes at the station, and all native dwellings situated far from the house. There we got no ~~fevr~~ fever, neither did we take any quinine.

I left the country in the following October and returned the following June in the capicity of a planter, and my wife and self went out to our estate and having no house we were compelled to live in a grass chitandu. It being cold weather, and there being no native huts near us, we took no quinine and suffered no fever. The ~~site~~ site for our brick house being a difficult one to prepare, I built a wattle and daub near to where the work was going on. We still remained free of fever as no natives were living near us. In the following April, my wife had necessity to go in to Zomba to await the birth of my little daughter and while waiting there must have been bitten by an infected mosquito, because exactly ten days after her arrival in Zomba, and the day after her confinement, she develop--ed malarial fever and was treated for it by Dr. Stannus. She came back home about two weeks after leaving the hospital, and though apparently all right must have had infected corpuscles still in her blood and no doubt infected our mosquitoes, because both the child and I went down with fever some short time after their arrival home.

As soon as our brick house was finished we went into it, and I, knowing that native childred harboured malarial germs, removed all native villages from that part of the estate. The only native huts which can be said to be anywhere near our house are the brick huts built for the occupation of the house boys and <u>no children</u> are allowed to sleep there. These huts are about three hundred yards away from the house. There are no other native huts within a quarter of a mile, or, I should say, quite six hundred yards. While living under these conditions, we did not systematically take quinine and for the twelve months we resided in the brick house before going home, we only on one occasion had fever, and that was exactly ten days after returning from a week end visit to some friends who did not live under our conditions. I am sure we were both bitten there and suffered accordingly, the child escaping, through having been put to bed before dark and remained safe under her mosquito net.

In conclusion, I would advise as a precaution against malaria the following:- <u>If possible</u>, remove all native villages from a European dwelling house a distance of at least six hundred yards. Take daily 5 grains of quinine, or twelve and a half grains every Saturday and Sunday. I have tried for long periods both systems and cannot say I have any preference to either method, both having been thoroughly efficient. These prophylactic doses for the highlands of Nyasaland I consider necessary all the year except perhaps during the months of May June and July, provided one is living in the aforementioned isolated condition as regards native villages. If not, it must be carried on throughout the year.

It is my steadfast belief, founded on twenty one years observation and personal trial, that if a European will faithfully take quinine in the manner mentioned without ommission, he will remain entirely free of fever under all conditions. I will, however, give no quarantee as regards his digestion, although I have found quin. hydrobrom. and quin. hydrochlor. give little or no trouble in this direction, as compared with bisulphate.

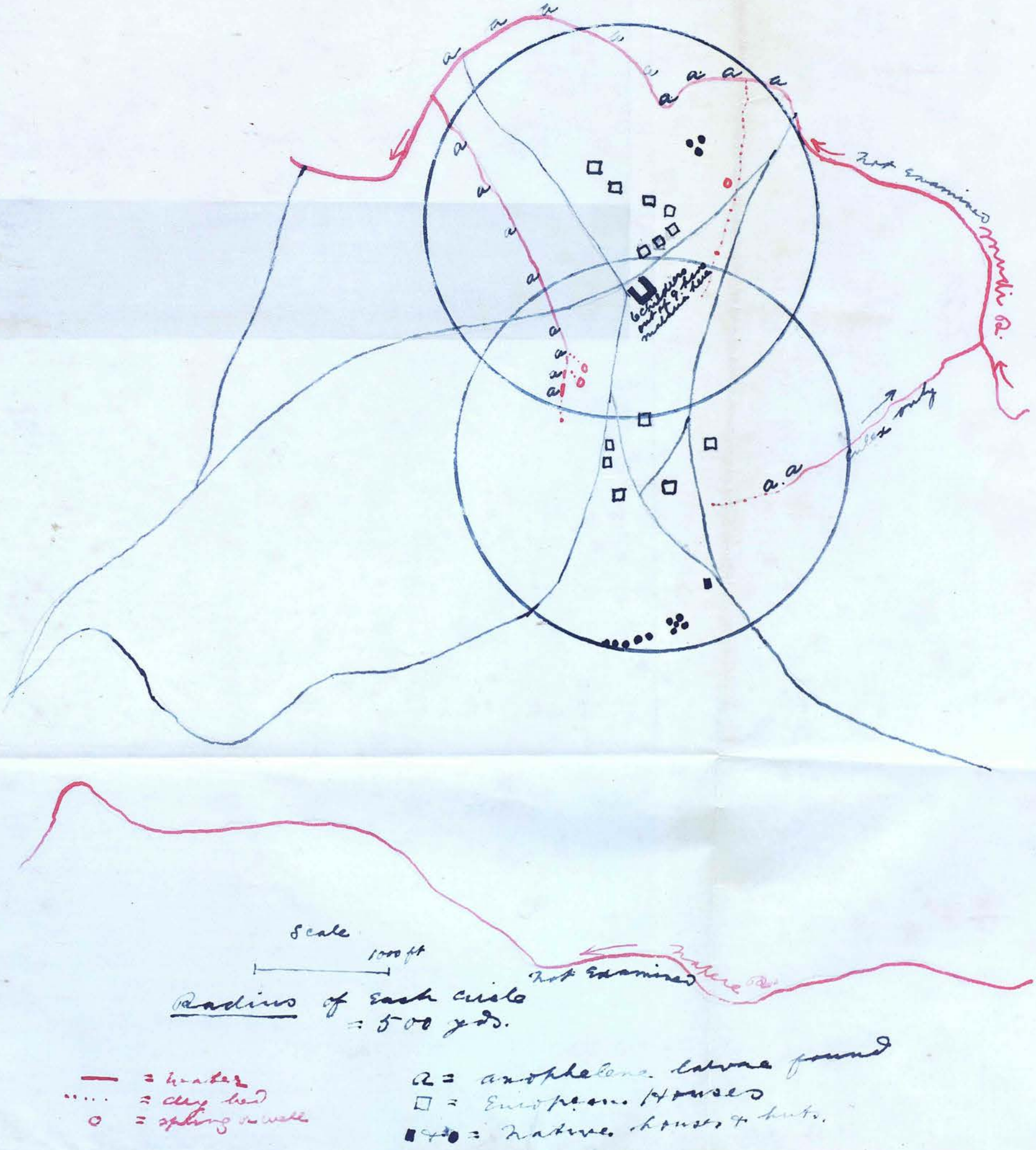
I remain
Dear Dr.
yours sincerely
A. F. Wallace Ross

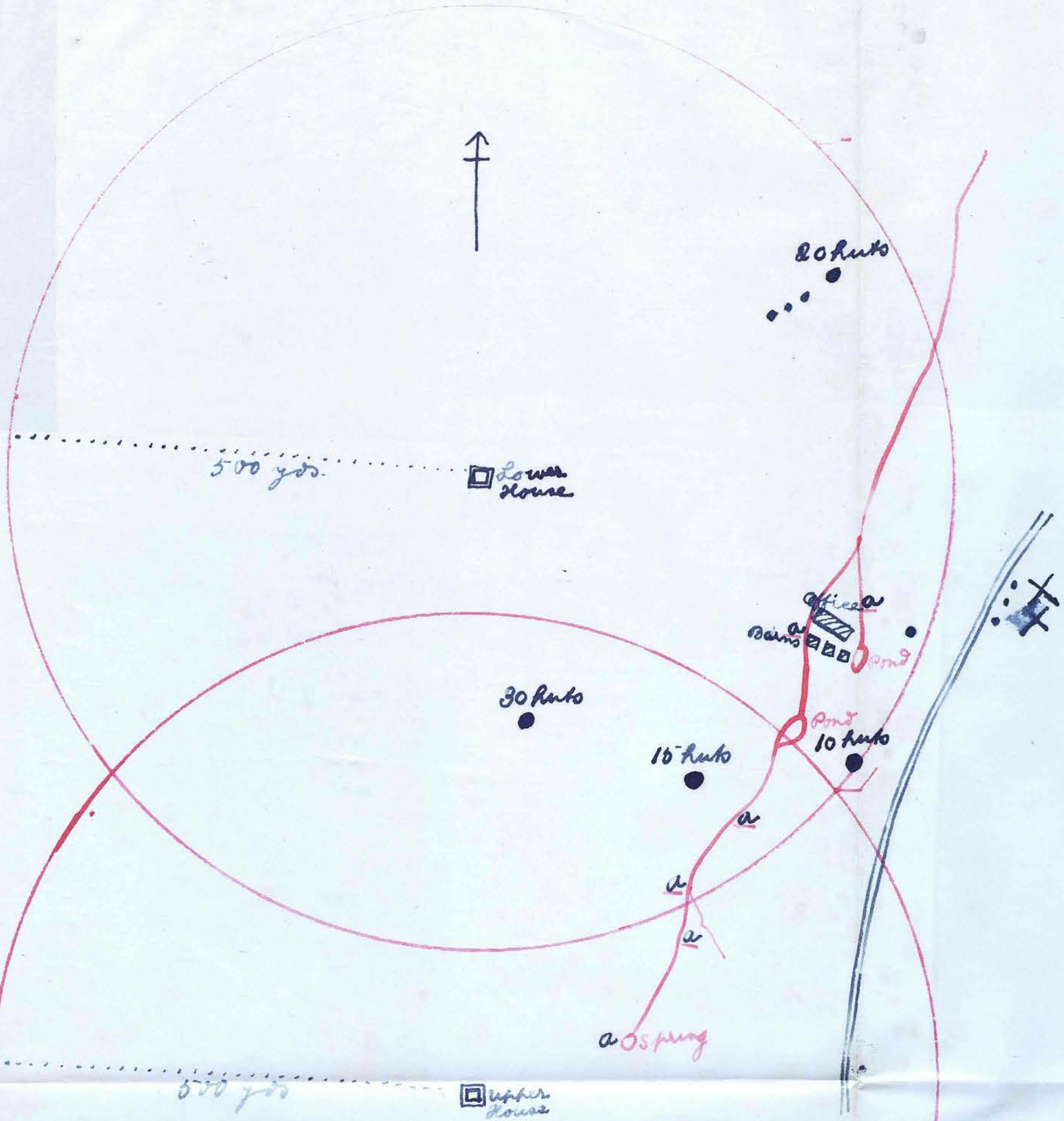
P.S. It might be argued that if the native villages be removed beyond the distance of flight of an infected mosquito, then there is no need to take any prophylactic doses of Quinine. Theoretically it would not be necessary, if one could guarantee not getting bitten by infected mosquitos, but one cannot prevent ones friends, harbouring parasites, coming to spend nights at ones house & infecting ones own local mosquitos, nor can one promise never on any account to sleep in ones friends houses, who might have the views of "Entomologists"-

I

Plan showing that both groups of Mandala houses are at present within 600 yds both of anopheline breeding grounds and infected native children and showing the distribution of the same.

Sept. 26th 1914





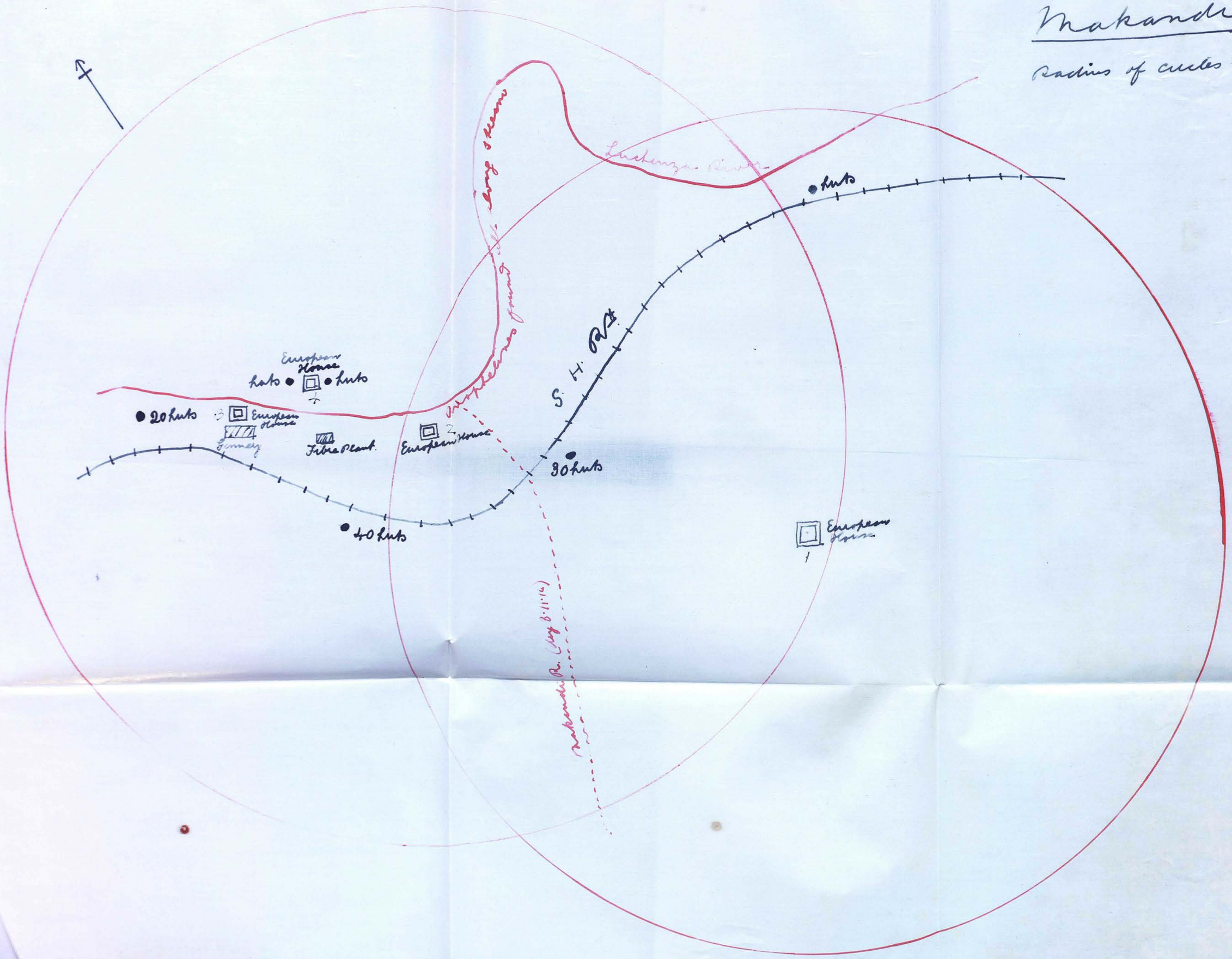
Chirimba Estate.

a = anopheline breeding grounds.
● = native huts.
▣ = European House
▨ = other buildings
Radius of each circle is 500 yds.
XX = where huts required fairly near the house could be placed
20 children in huts
5 infected with malaria.

3

Makandi

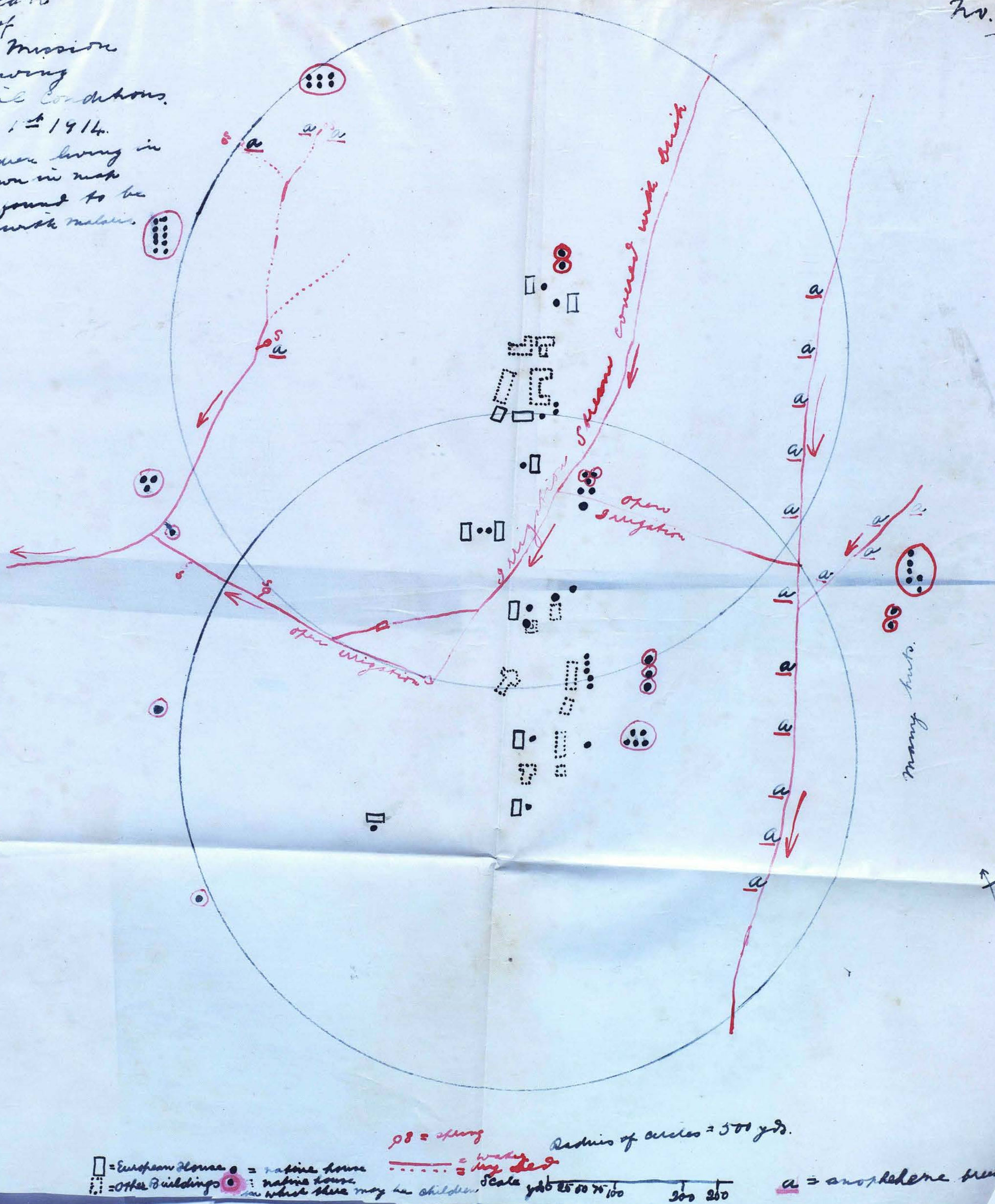
Radius of circles = 500 yds.



Plan
of
Blantyre Mission
shewing
Malarial Conditions.
Aug 1st 1914.

Of 82 children living in area shewn in map 9 were found to be infected with malaria.

No. 4



s = spring
= waking
= fence
Radius of circles = 500 yds.

= European House
= Office Buildings
= native house
= native house in which there may be children

Scale yds 0 250 500 750 1000 2000 2500

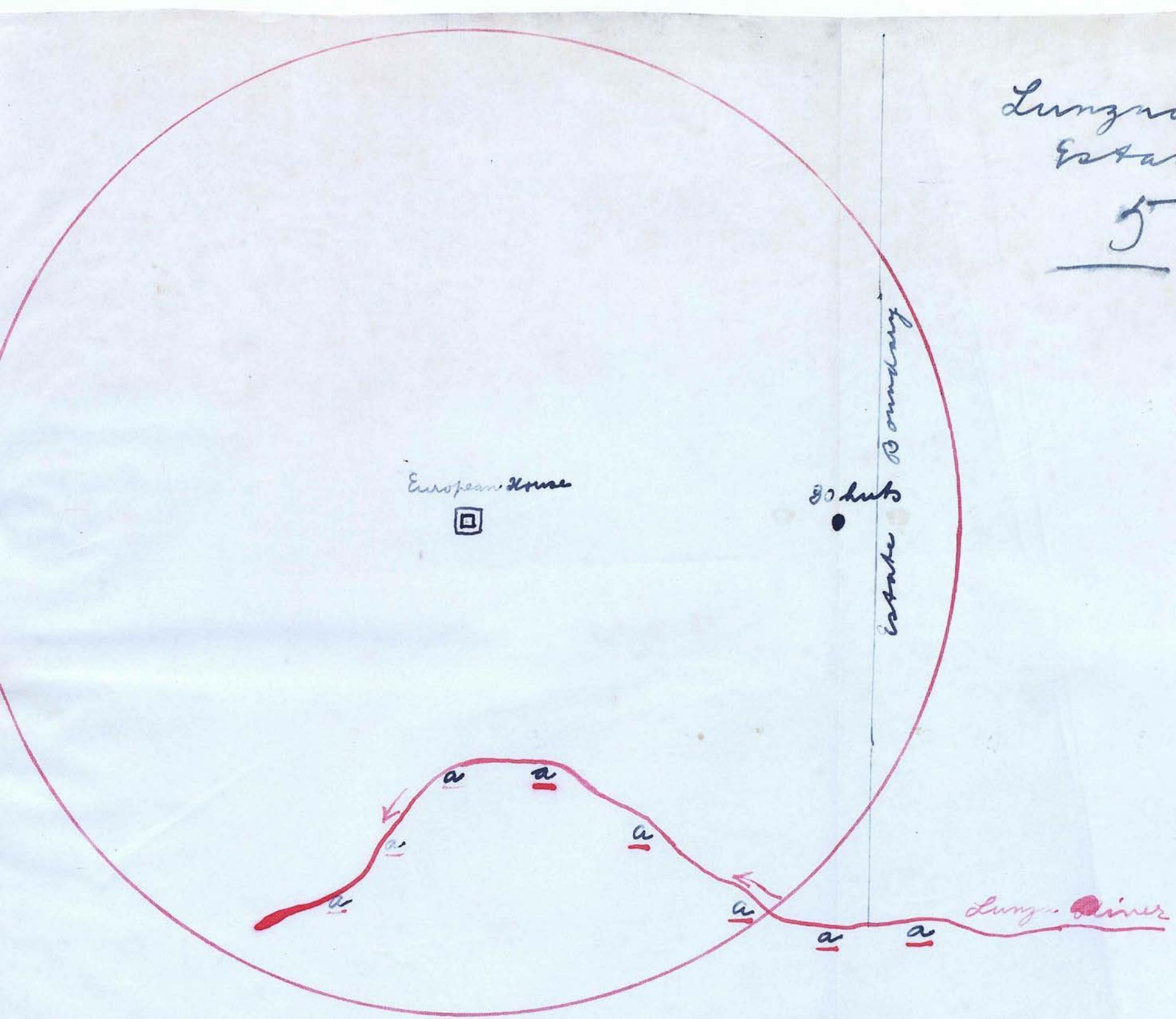
a = anopheline breeding places

Lungsodoro
Estate
5

European House

30 huts

Estate Boundary



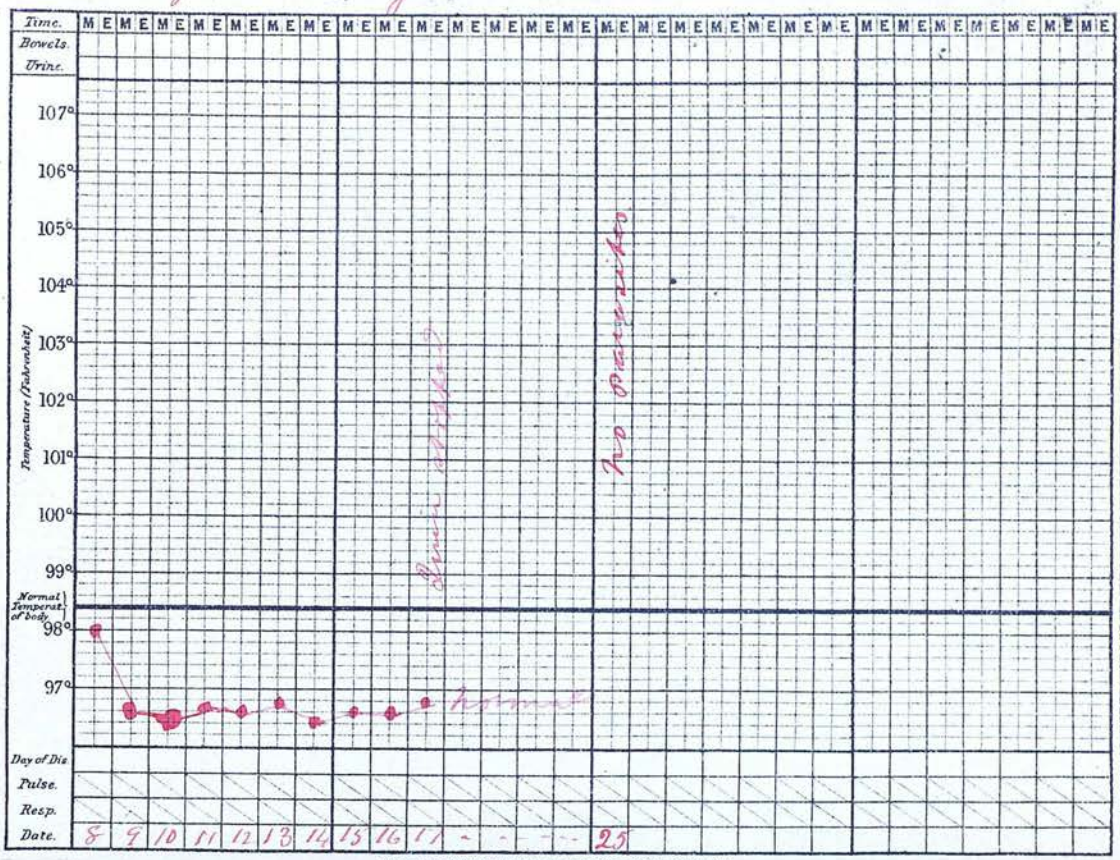
Scale
100 200 300 yds

a = anopheline breeding places
~~~ = water
radius of circle = 600 yds.
~~~

Notes of Case

"Rings"
Spleen 0
Quin. Tannate
gr 5 daily

Name Mudyachikoto Age 3yr Disease Result 1



May

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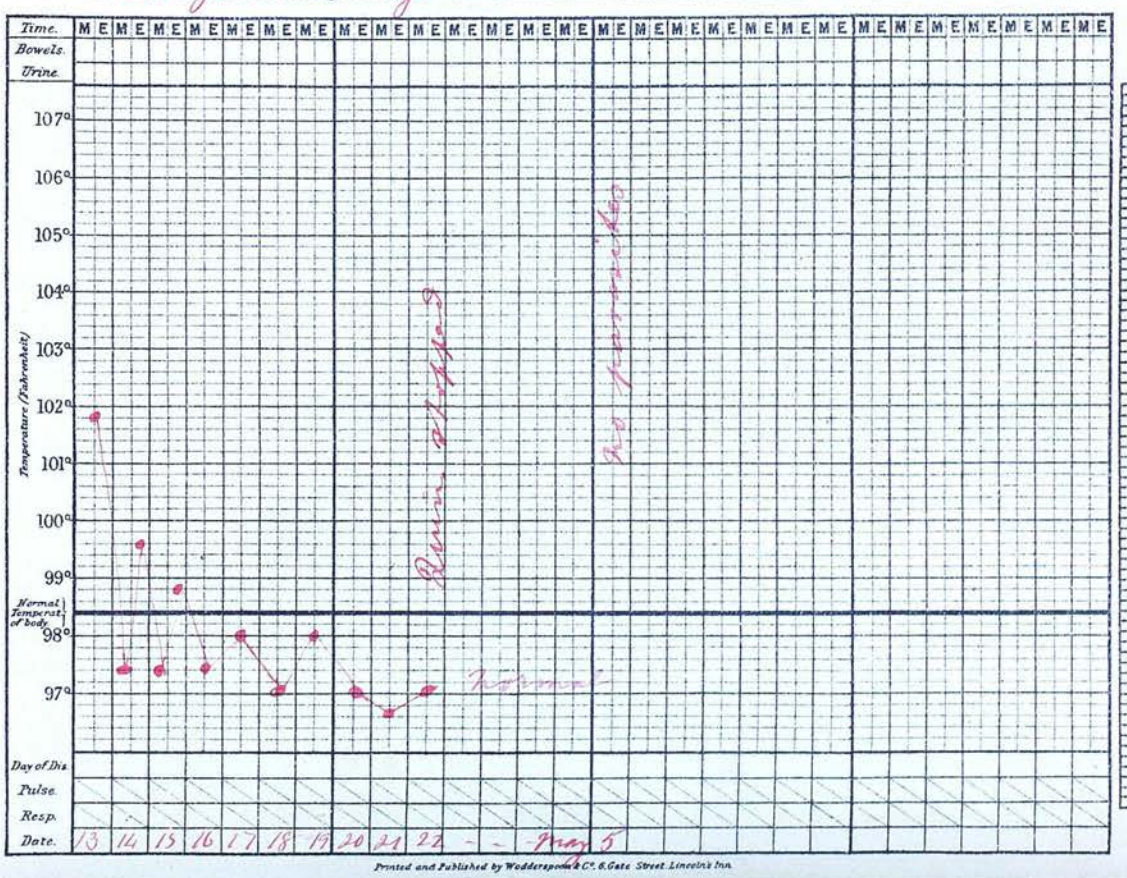
Notes of Case

"Rings"
Spleen +
Quin Tan.
gr 5 daily

Name Tsirizani Age 3yr Disease Result 2



April

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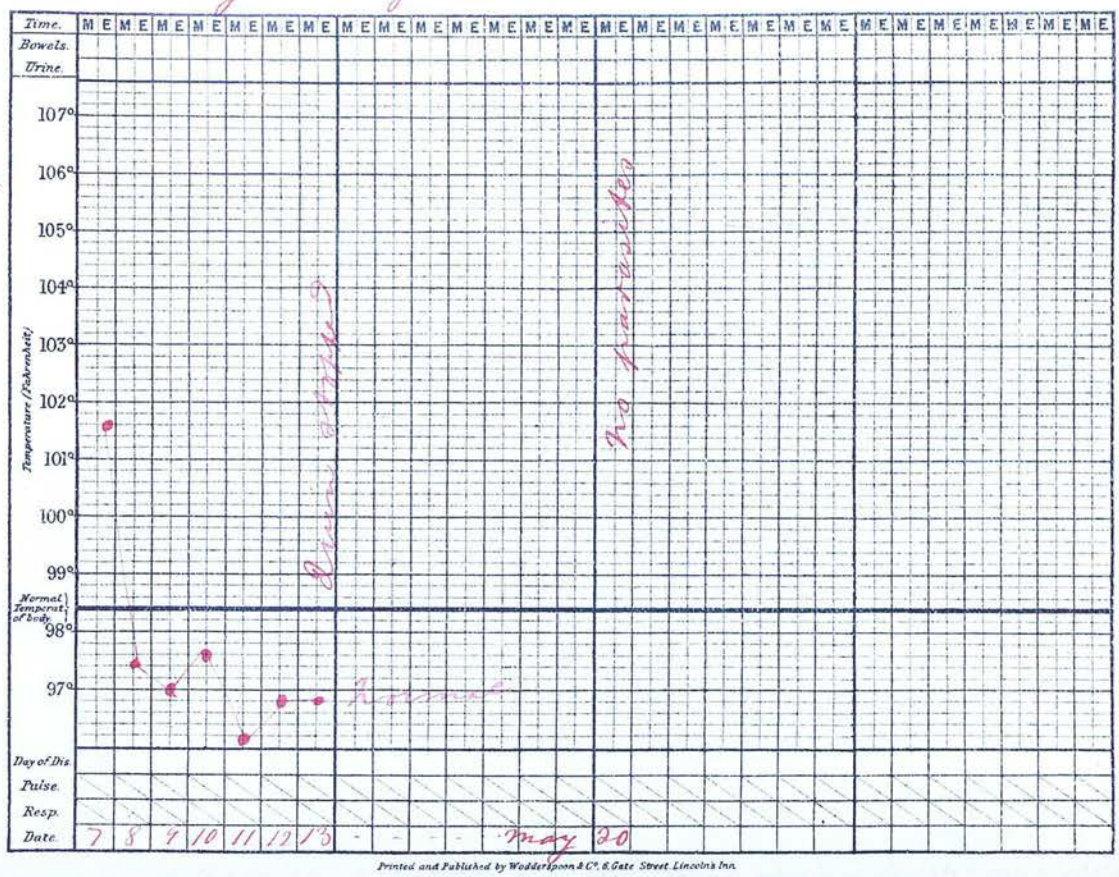
Notes of Case

"Rings"
Spleen +
Quin Bisulph
gr 5 daily

Name Ruby Age 6yr Disease Result 3

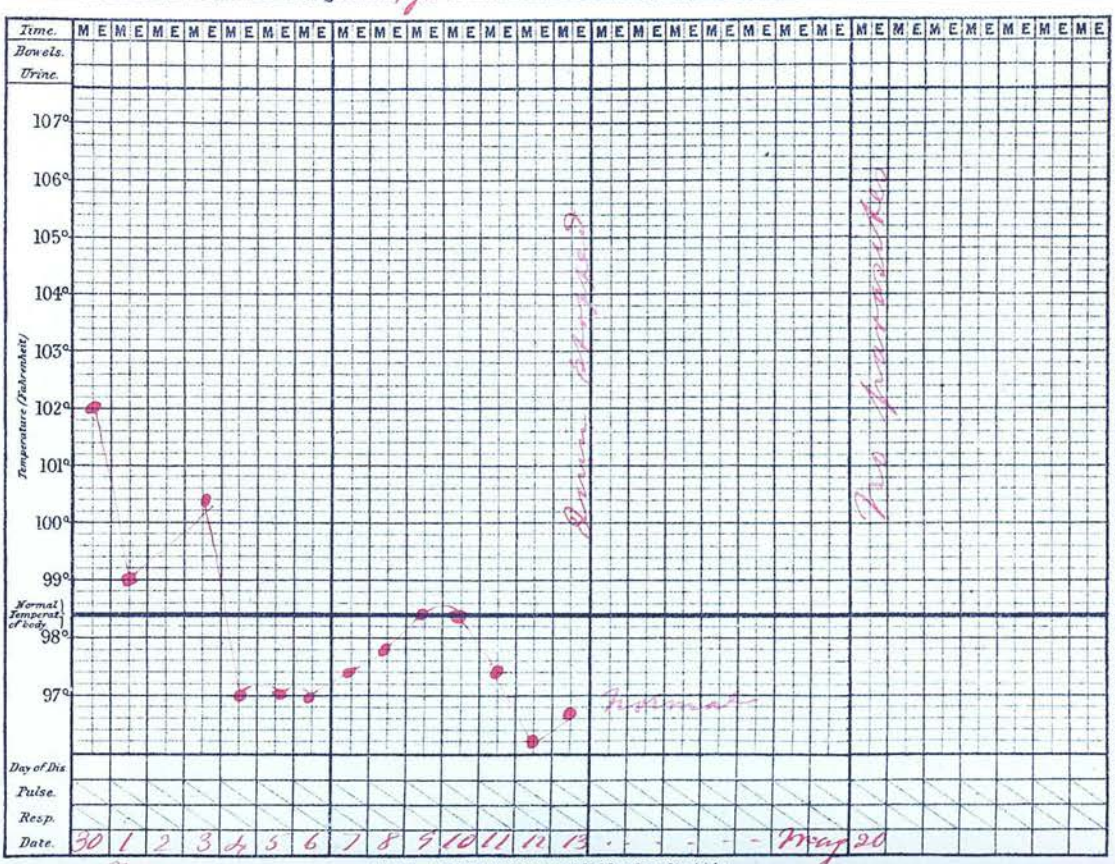


Printed and Published by Wodderspoon & Co. 8 Gate Street Lincoln's Inn.

Notes of Case

"Rings"
Spleen +
Quin. San.
gr 5 twice
daily

Name Harold Age 4yr Disease Result 4

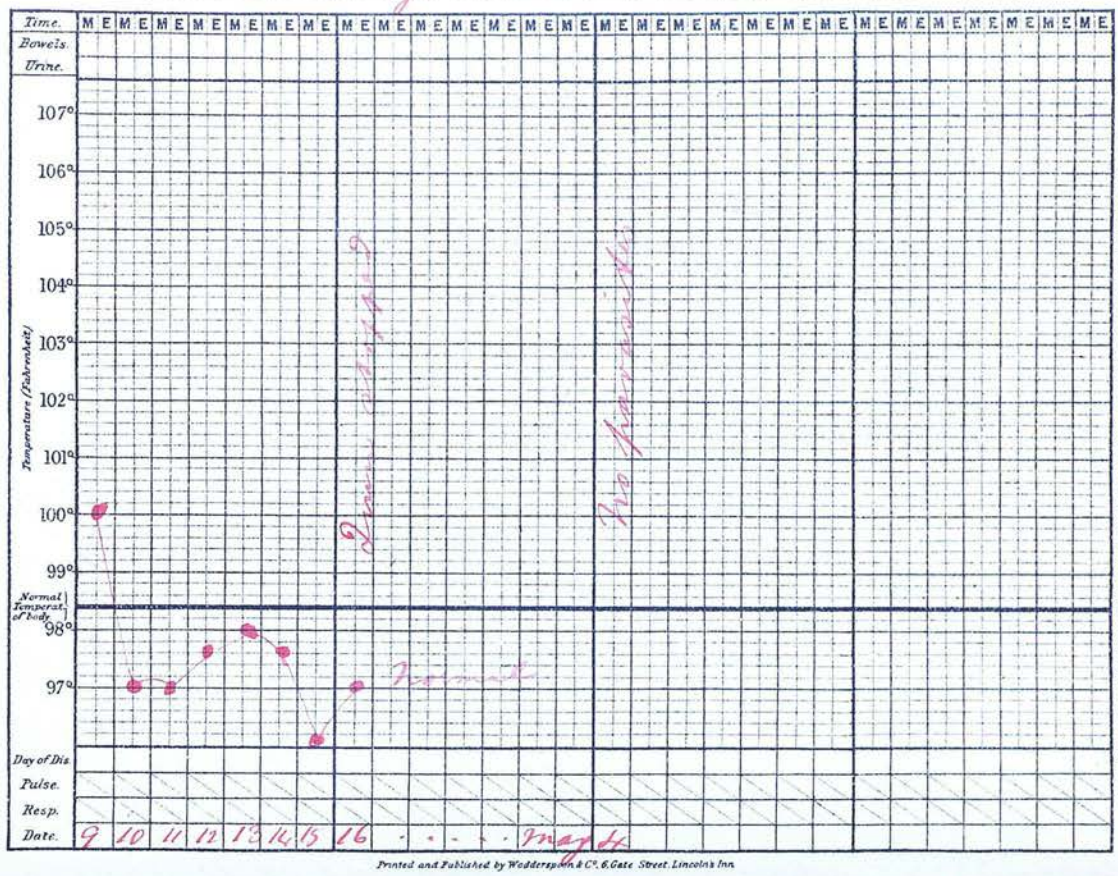


Printed and Published by Wodderspoon & Co. 8 Gate Street Lincoln's Inn.

Notes of Case

Numerous "Crescents"
Quin. Tan. gr 5 twice daily

Name Aaron Age 5yr Disease Result 5



April

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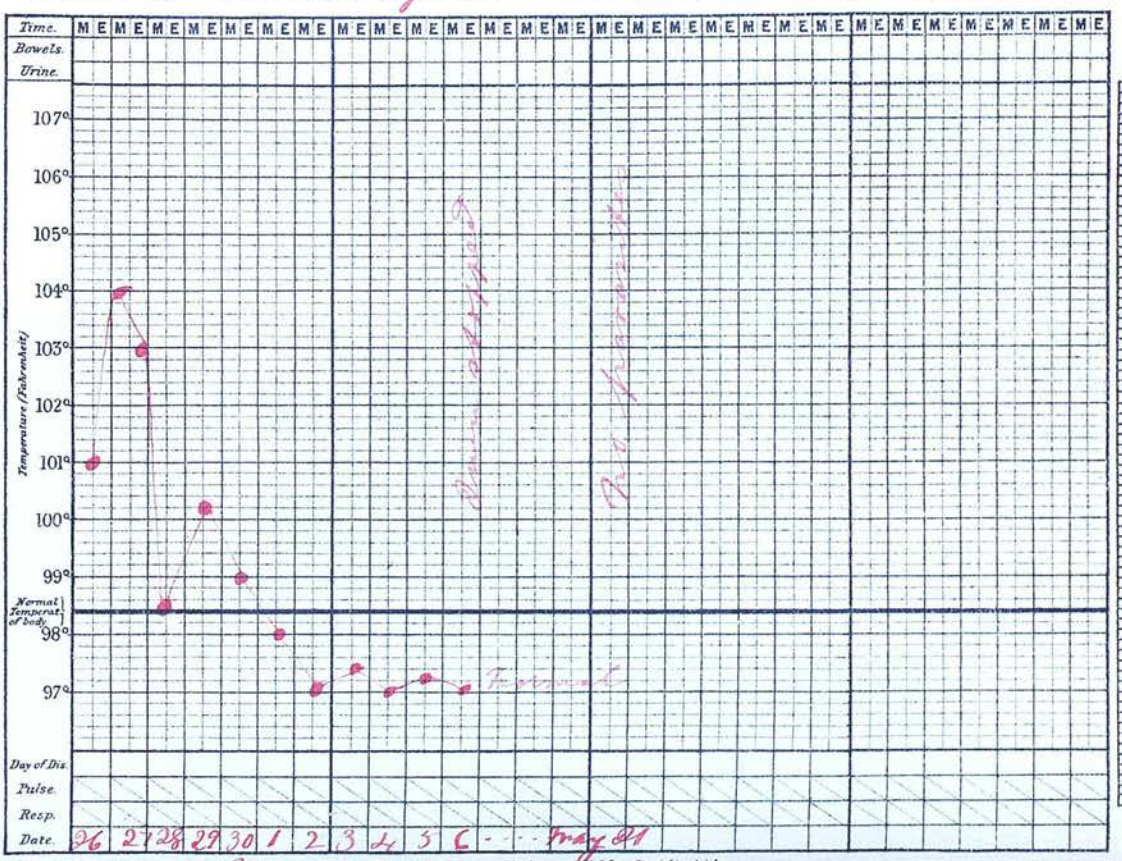
Notes of Case

"Rings"
Spleen 0
Quin. Tan. gr 5 Daily

Name Frank Age 2yr Disease Result 6



April

May

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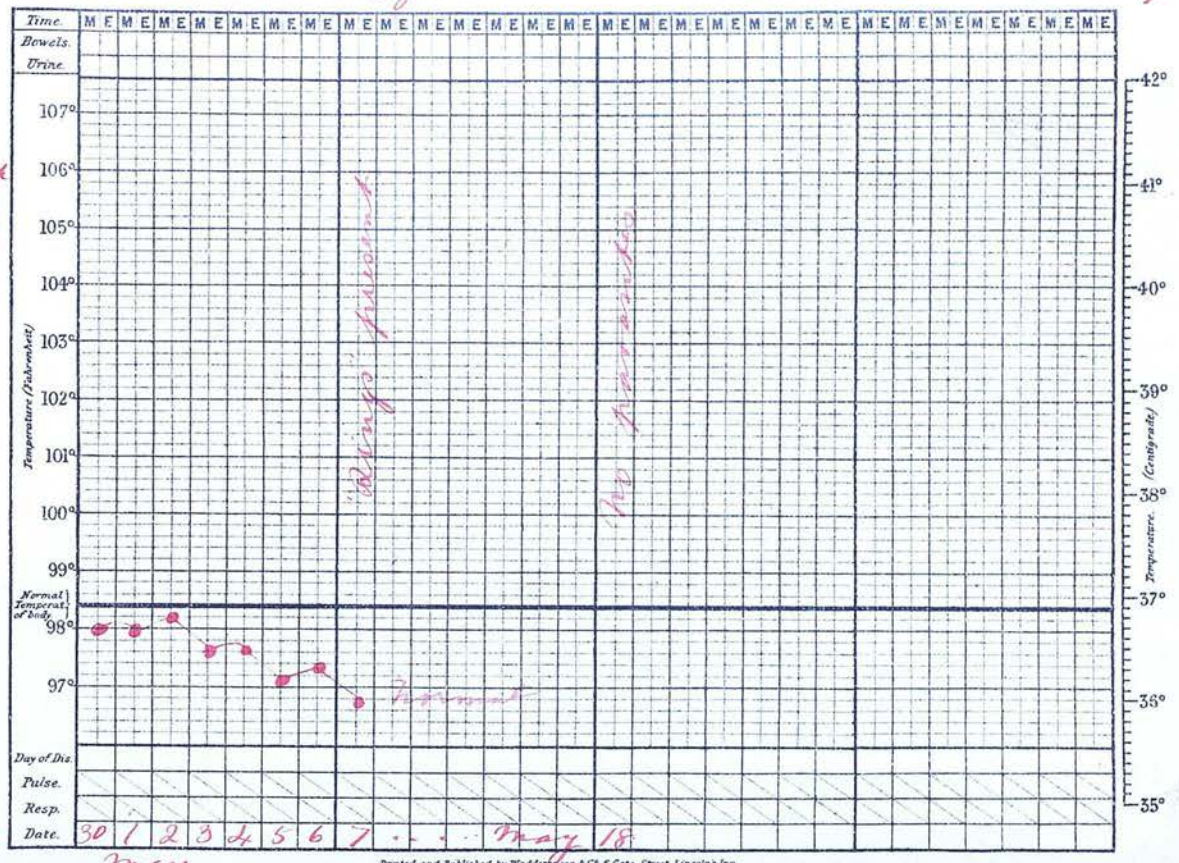
Notes of Case

"Rings"
Spleen 0
Quin Bisulph
gr 2½ daily

Name Beswick Age 3yr Disease Result 9

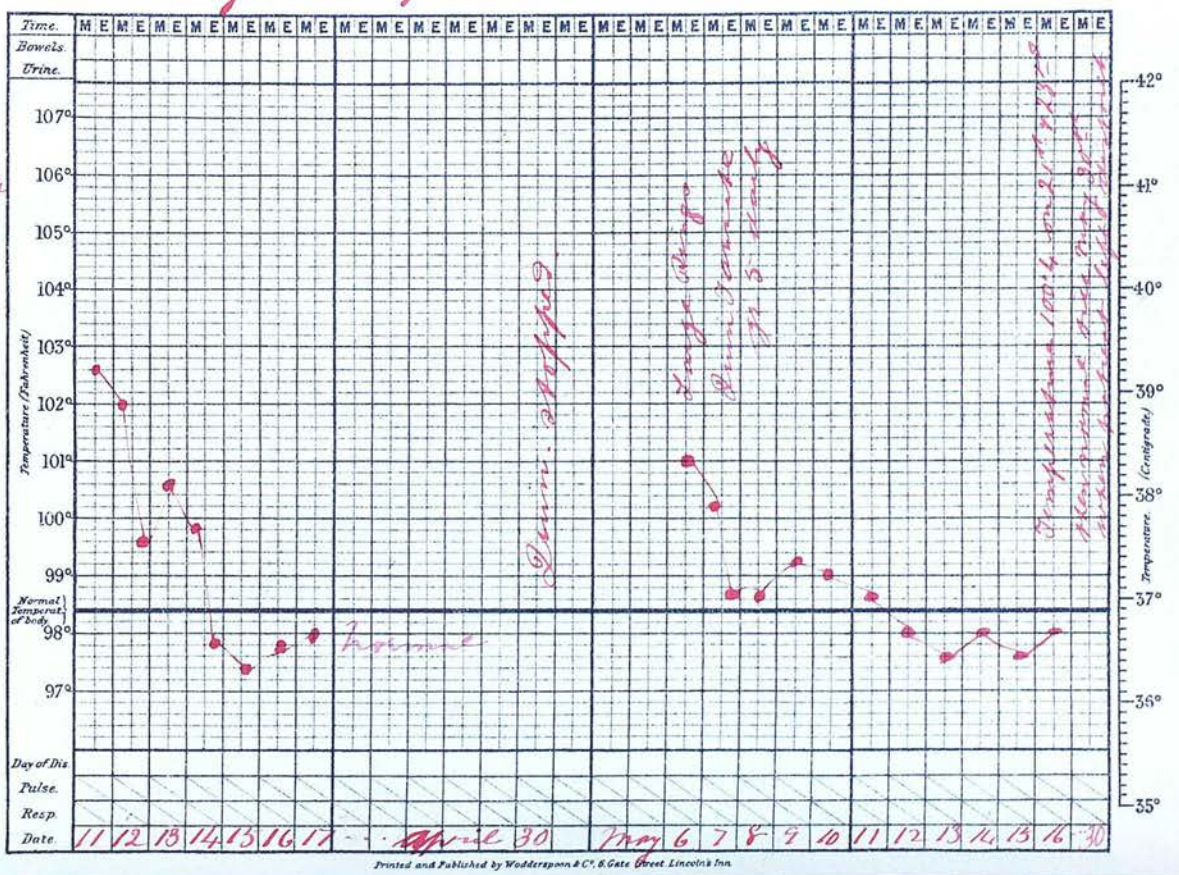


Printed and Published by Wodderspoon & Co. 6 Gate Street Lincoln's Inn.

Notes of Case

"Rings"
Spleen +
Quin Bisulph
2½ gr daily
(in syrup)

Name Akunjawa Age 1½ yr Disease Result 10

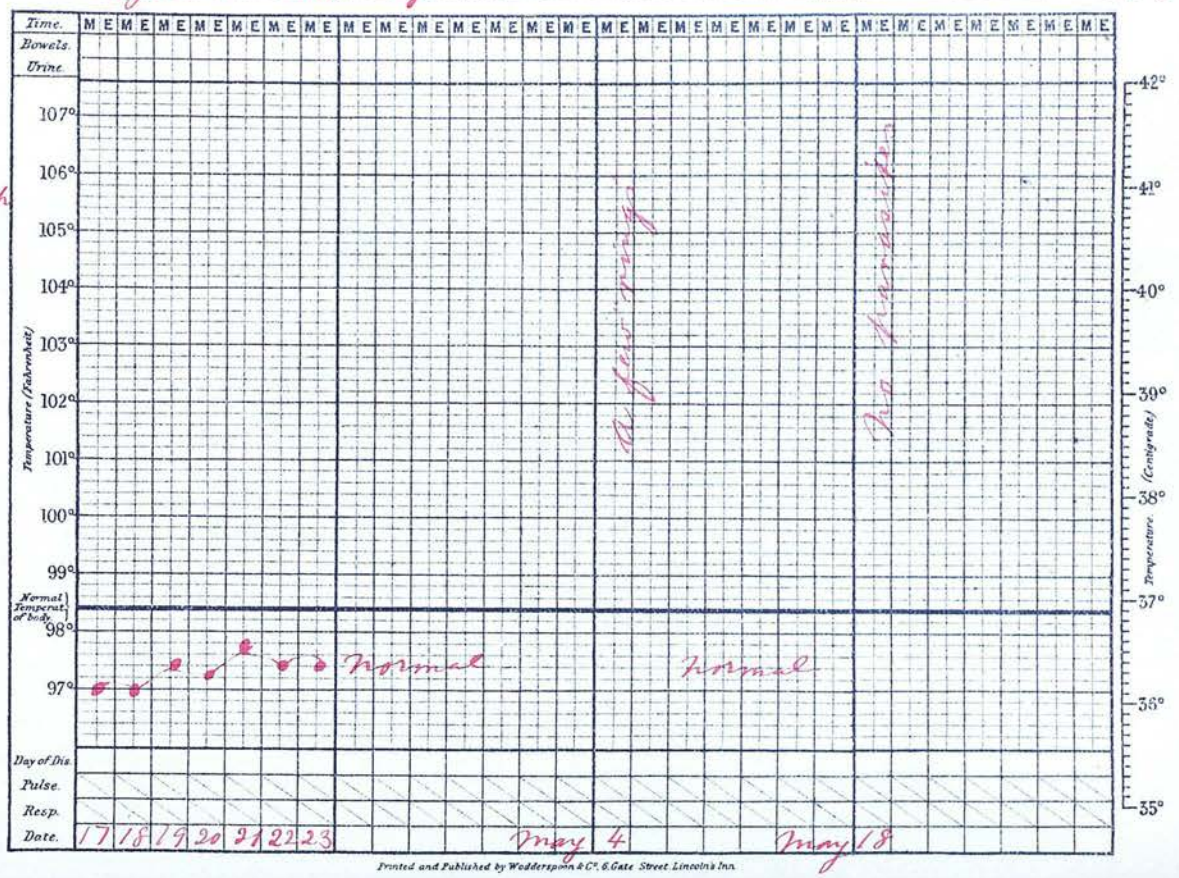


Printed and Published by Wodderspoon & Co. 6 Gate Street Lincoln's Inn.

Notes of Case

"Rings"
Spleen +
Quin Bisulph
gr 5 twice
daily

Name Dziwawetsky Age 13 yr Disease Result 13



April

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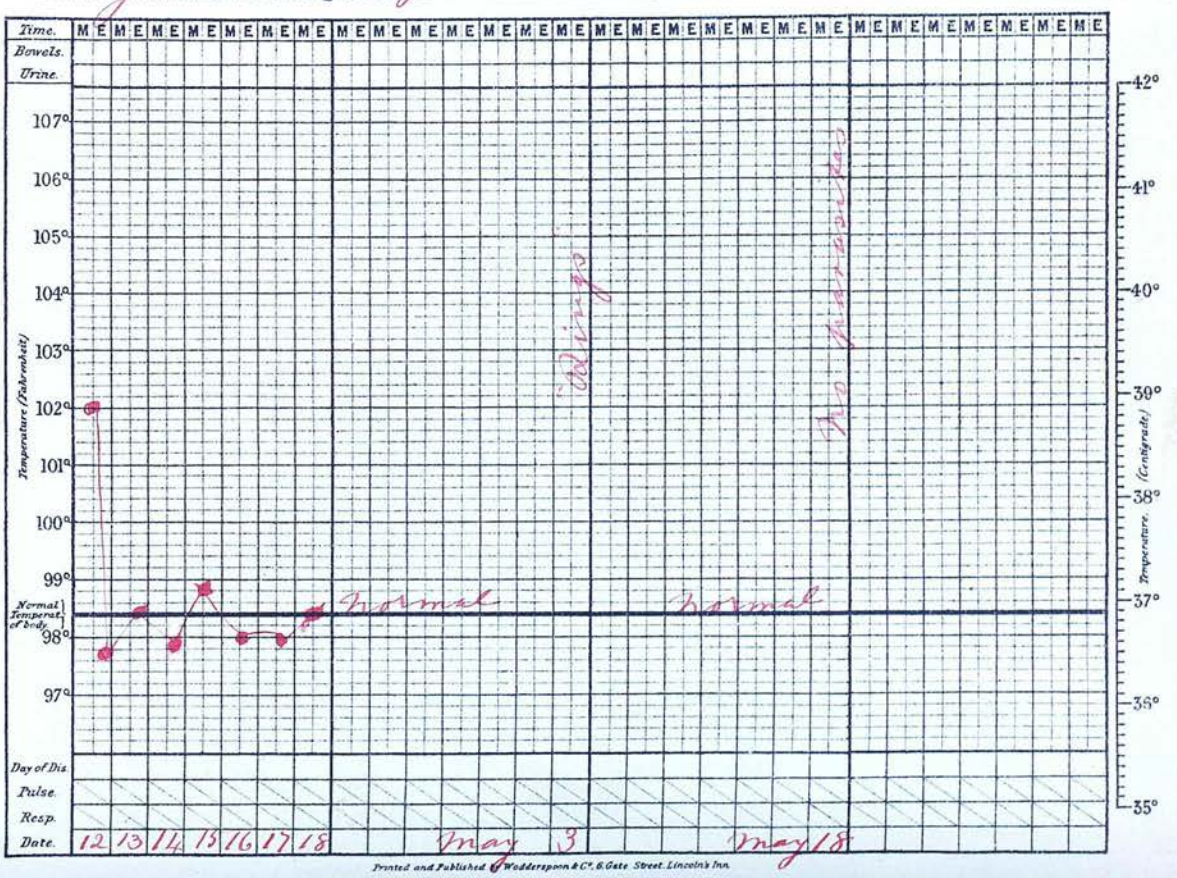
Notes of Case

"Rings"
Spleen 0
Quin. Sulph.
gr 5 daily

Name John Age 2½ yr Disease Result 14



April

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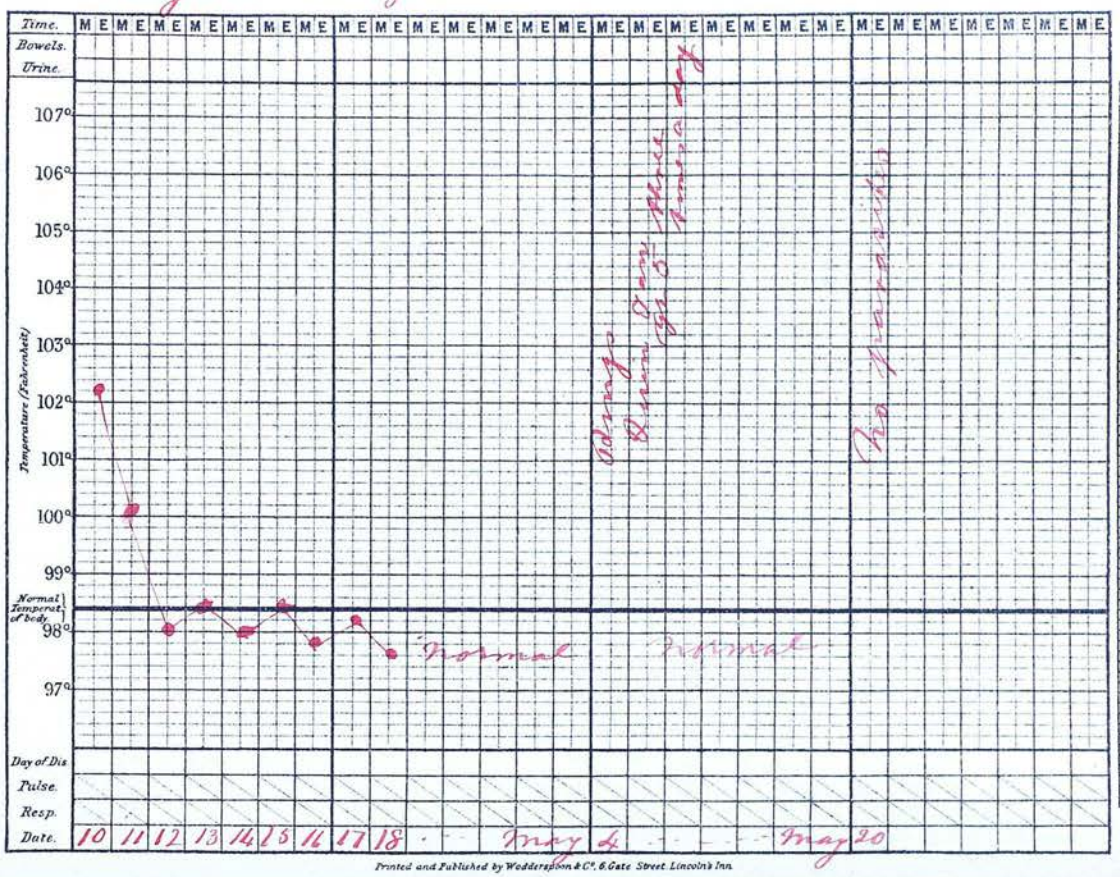
Name Eugene Age 4 yr. Disease Result 15

Notes of Case

"Rings"
Spleen 0
Quin. Tan.
gr 5 twice
daily



April

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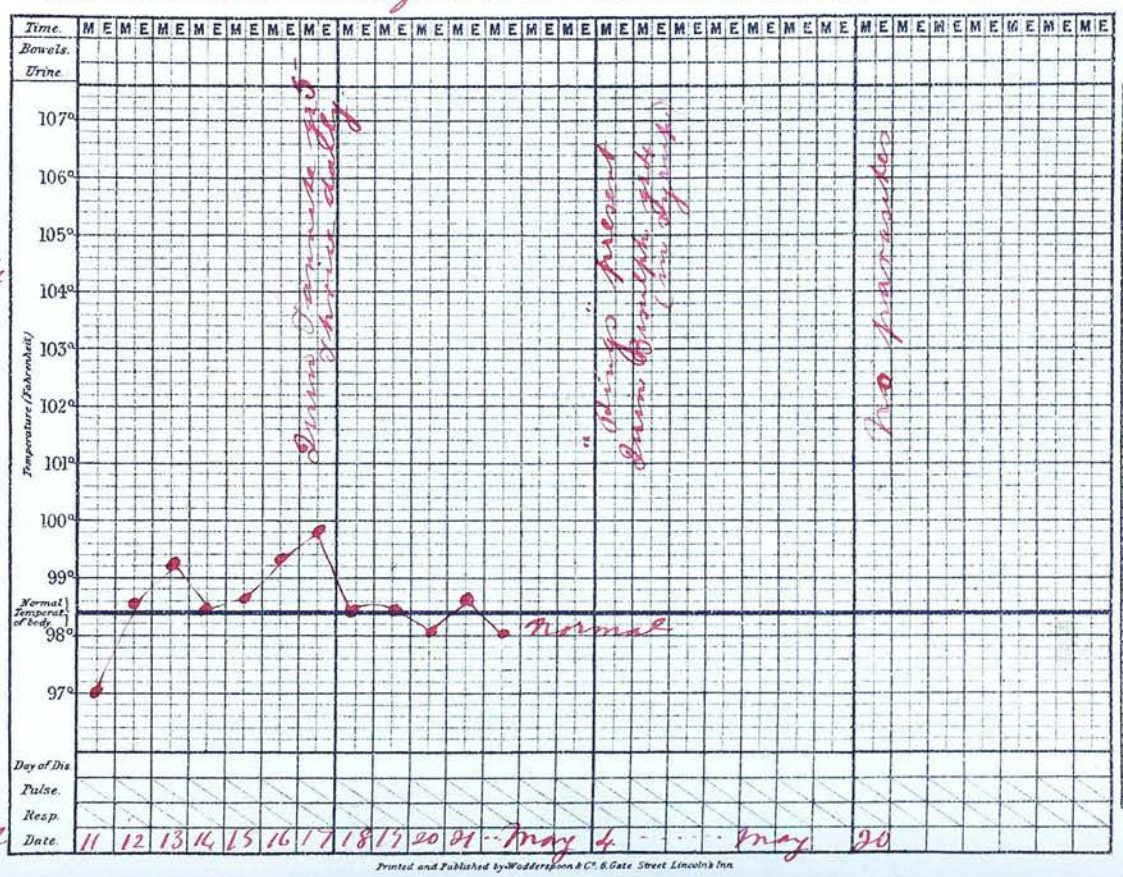
Name Charlie Age 5 yr. Disease Result 16

Notes of Case

"Rings"
Much pig-
ment.
S +
Quin. Tan.
gr 5
Twice daily



April

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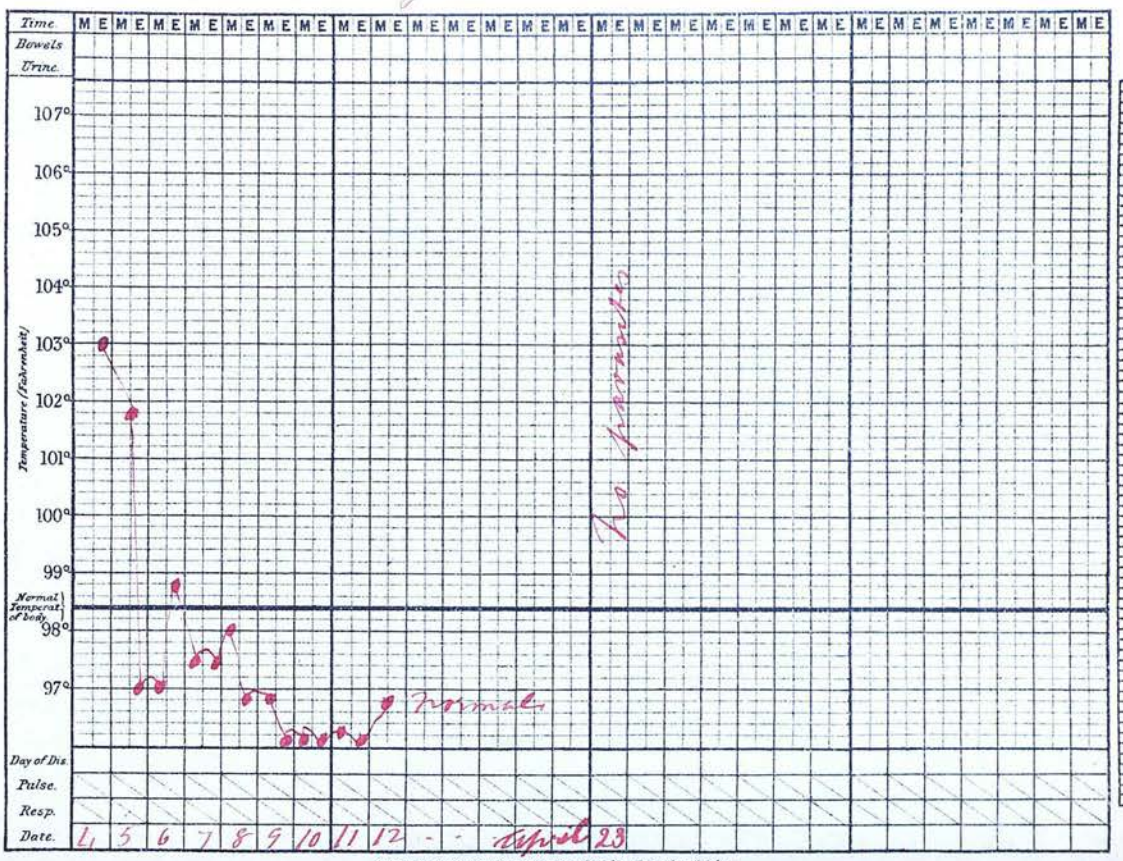
Notes of Case

"Rings"
2 min Bisulph gr x twice daily for 2 days then once daily

Name Rota Age 18 yrs Disease Result 17



April

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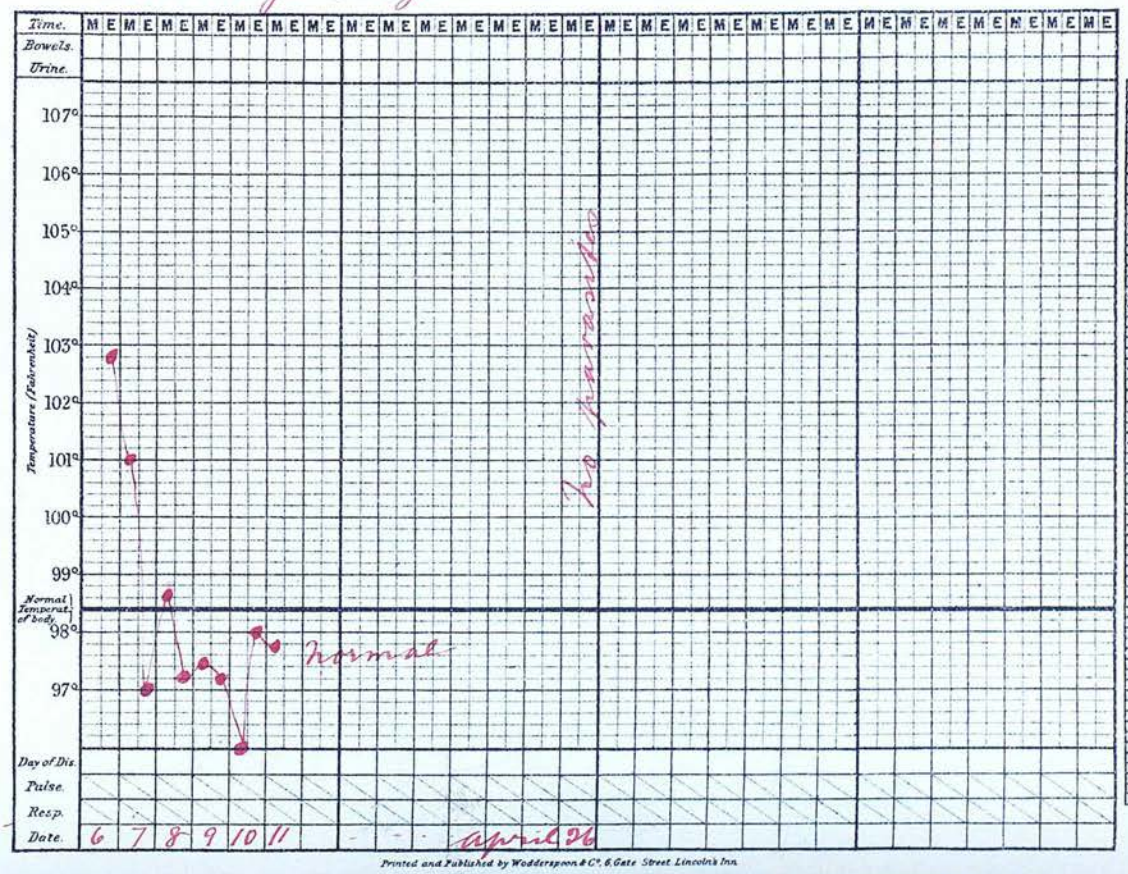
Notes of Case

"Rings"
2 min gr x in t.d. for 2 days, then once daily

Name Casaneye Age 18 yr. Disease Result 18



April

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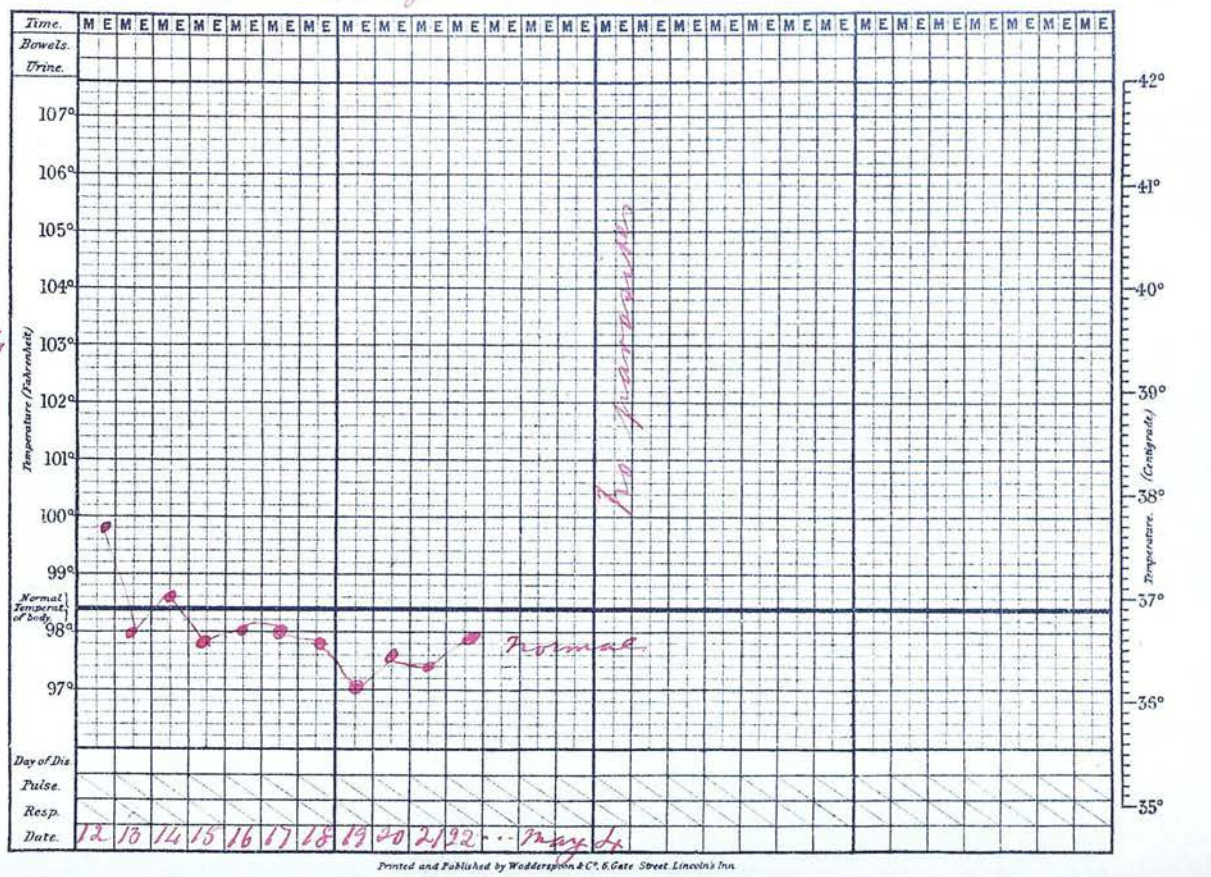
Notes of Case

"Rings"
Spleen ++
Quin Bisulph
gr X
Twice daily
for 2 days
then once daily
for 10 days

Name Berta Age 3 Oys Disease Result 21



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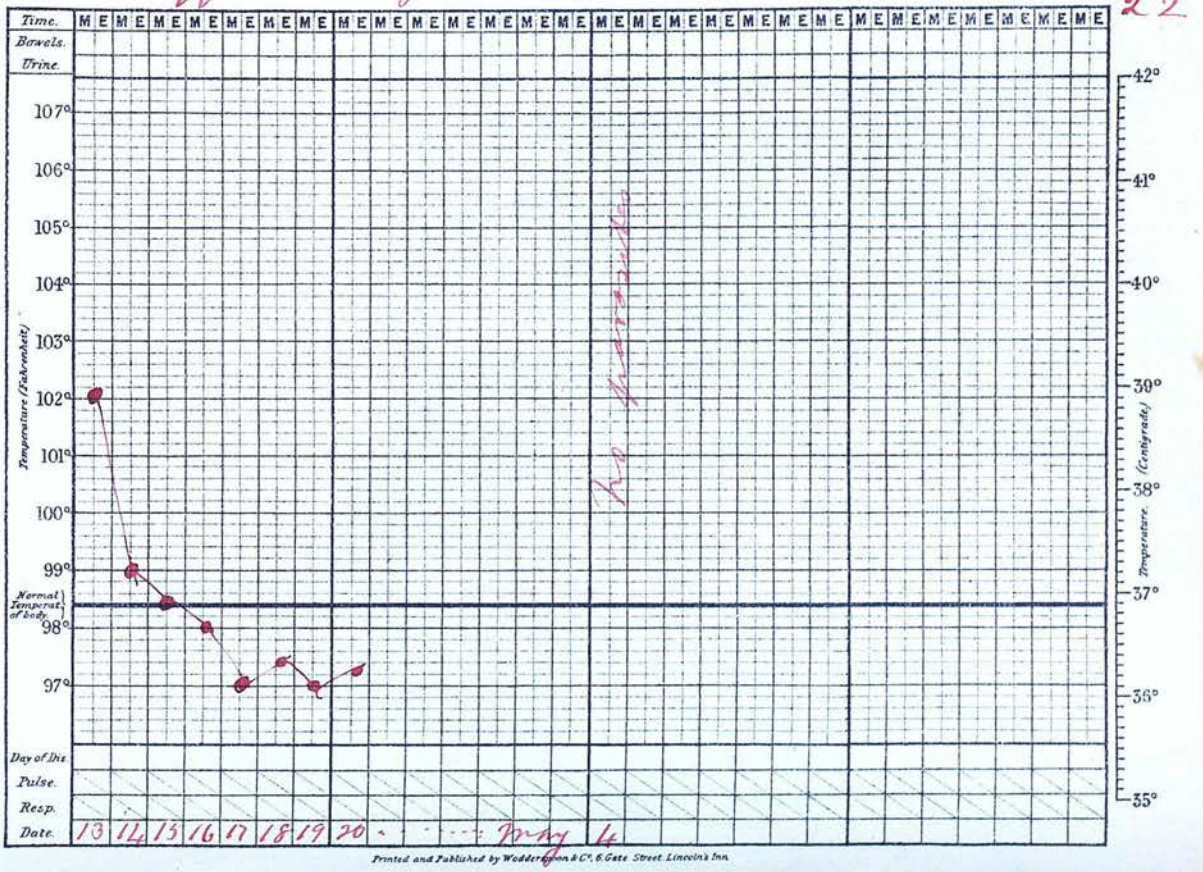
Notes of Case

"Rings"
Spleen ++
Quin gr X
daily for
10 days

Name Moffat Age 2 Oys Disease Result ~~20~~ 22



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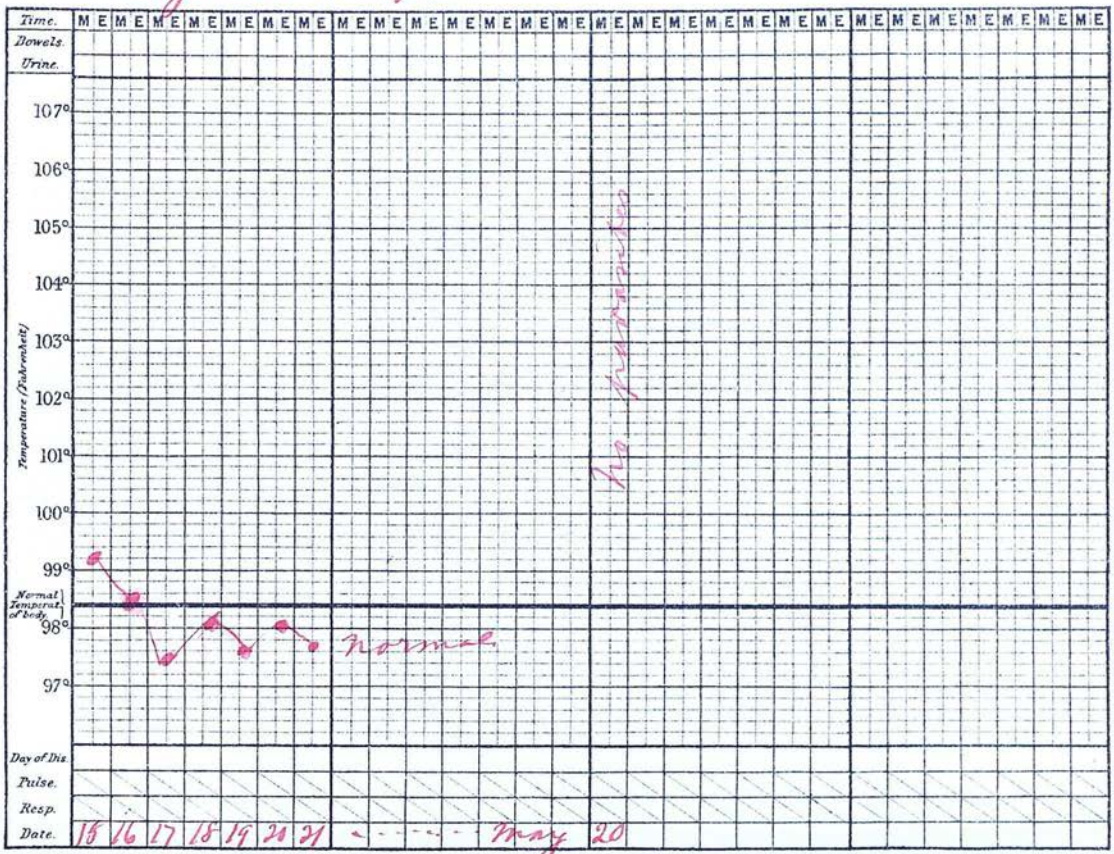
Name Magombo Age 26yrs Disease Result 23

Notes of Case

"Rings"

Spleen ++

Quin gr X
Twice daily
for 2 days
then once
daily for 10
days.



April

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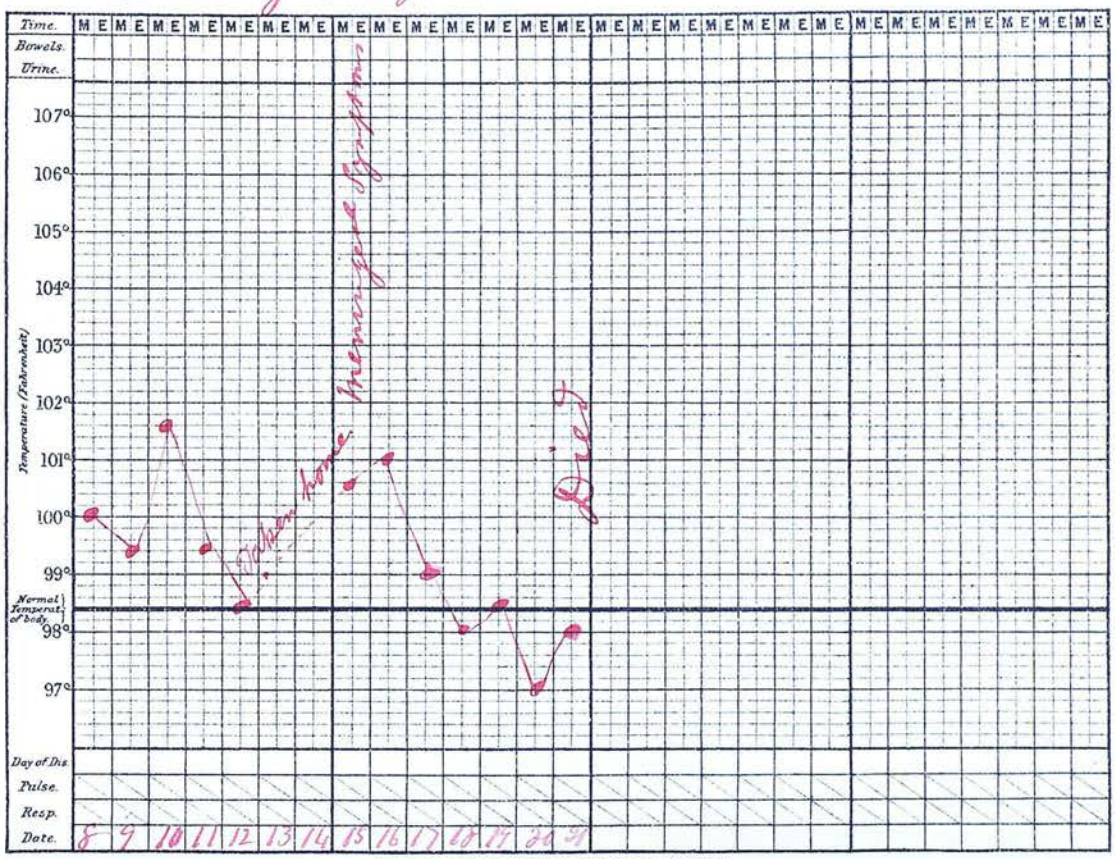
Name C. Harley Age 3½ yr Disease _____ Result _____ 24

Notes of Case

"Rings"
Splent
Quin Bisulph
2½ gr. m.d.s.



Oct

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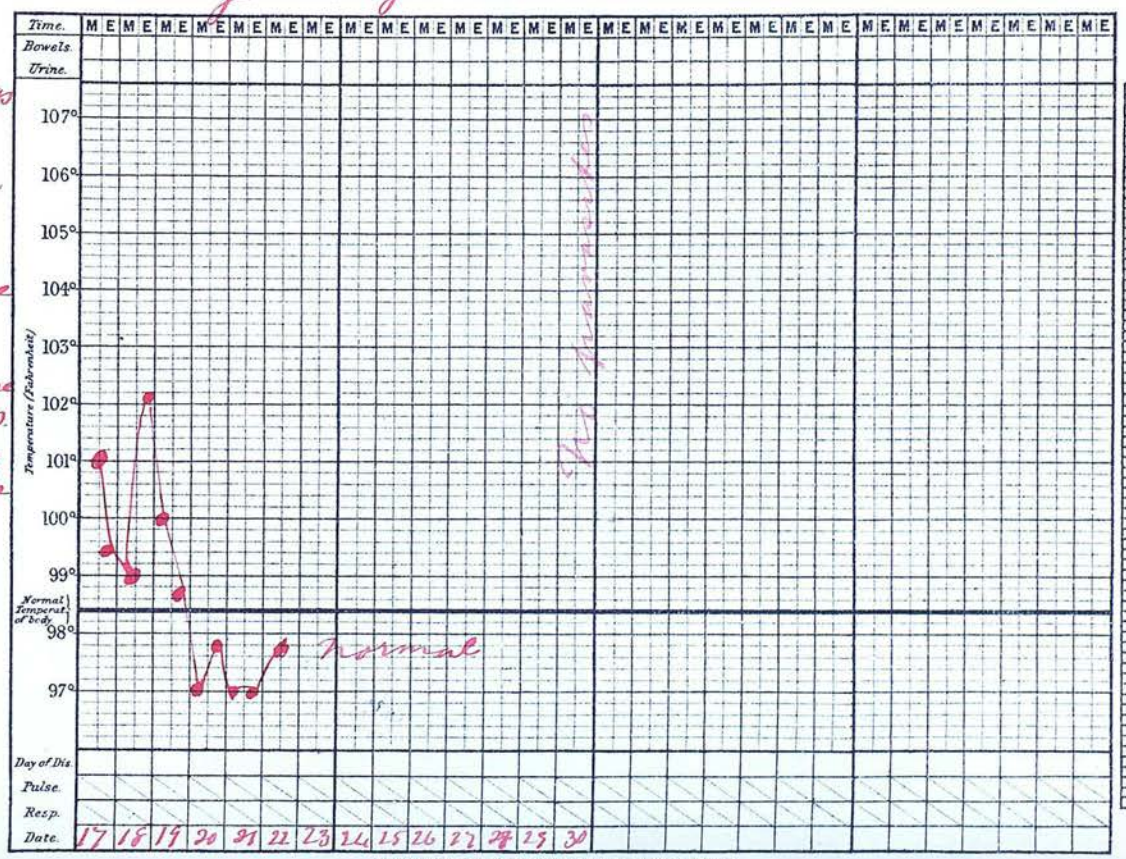
Name Mary Age 6 yr. Disease _____ Result _____ 25

Notes of Case

Numerous Rings
S. —
Quin Bisulph
gr 3 twice
daily for 7
days, then once
daily
Patient comatose
for first 24 hrs.
with spasm to
right, but able
to swallow
quinine



May

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